Mid-Coyote Flood Protection Project

Baseline Fisheries Monitoring Report Year 2 (2008)

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Introduction

Project Goals

As part of the Mid-Coyote Creek Flood Protection Project, the Santa Clara Valley Water District (District) is conducting a pre-project baseline fisheries investigation to inform the project team about the status of the current fishery within the project footprint. This baseline investigation will be conducted for three consecutive years (2007-2009). The information gathered in these investigations will be used to evaluate the project's potential impacts to the stream corridor as it relates to aquatic resources. This information will also be used to develop the appropriate mitigation for the chosen project alternative and identify enhancement opportunities for native fish in the project reach and the entire Coyote Creek watershed. All study conclusions, mitigation recommendations, and enhancement opportunities will be provided to the regulatory and resource agencies as well as other interested parties following the final year of the study in 2009.

Baseline Fisheries Survey 2008

The proposed flood protection project encompasses a 6.1 mile stretch of the mainstem of Coyote Creek between Montague Expressway and Highway 280. In order to characterize the aquatic habitat conditions within the project limits and serve as a basis for the fisheries monitoring, a comprehensive habitat survey was conducted between July 31 and August 11, 2006 for the entire length of the project reach.

The baseline fisheries study focuses mainly on the project reach for impact analysis, however, Upper Penitencia and Lower Silver Creek were also included since they have confluence points within the project footprint. In addition, to reference conditions upstream of the project site, four additional monitoring sites were established upstream of the project limits on the mainstem of Coyote Creek. The four sampling locations upstream of the project footprint were chosen to correspond with the previous work of Pitt and Bozemen fish sampling in 1977-1979 and the Santa Clara Valley Urban Runoff Pollution Prevention Plan (SCVURPPP) fish sampling in 1999 (Pitt et al., 1982) (SCVURPPP, 2001). This approach will allow a comparison between the various studies and provide fish assemblage data from years where there was variability in the natural hydrologic conditions. In 2008, the District added an additional sampling site at Tully Road on the mainstem of Coyote Creek (Upper Coyote Creek Site A2) to correspond with the macroinvertebrate sampling currently being conducted by SCVURPPP (Figure 1) (SCVURPPP, 2008).

Three additional sampling locations were selected for the 2008 sampling season to assist data collection efforts for the Three Creeks Habitat Conservation Plan (TCHCP). The three sites are within the proposed five mile management zone for steelhead trout in the upper portion of Coyote Creek (FAHCE, 2003). For the purposes of this report, these sites will be analyzed using the same methods as all of the other sites. The first site, TCHCP Site 1, is located upstream of Coyote Ranch Road. The second site, TCHCP Site 2, is located upstream of Coyote Golf Creek Drive while the third sampling location, TCHCP Site 3, is located adjacent to the Santa Clara County Parks rangers station downstream of Anderson Reservoir. A fourth supplementary site was chosen in 2008 at Metcalf percolation facility (MP Site B2; Figure 1). This site will be investigated further as a potential impediment to anadromous fish migration for the 2009 final report.

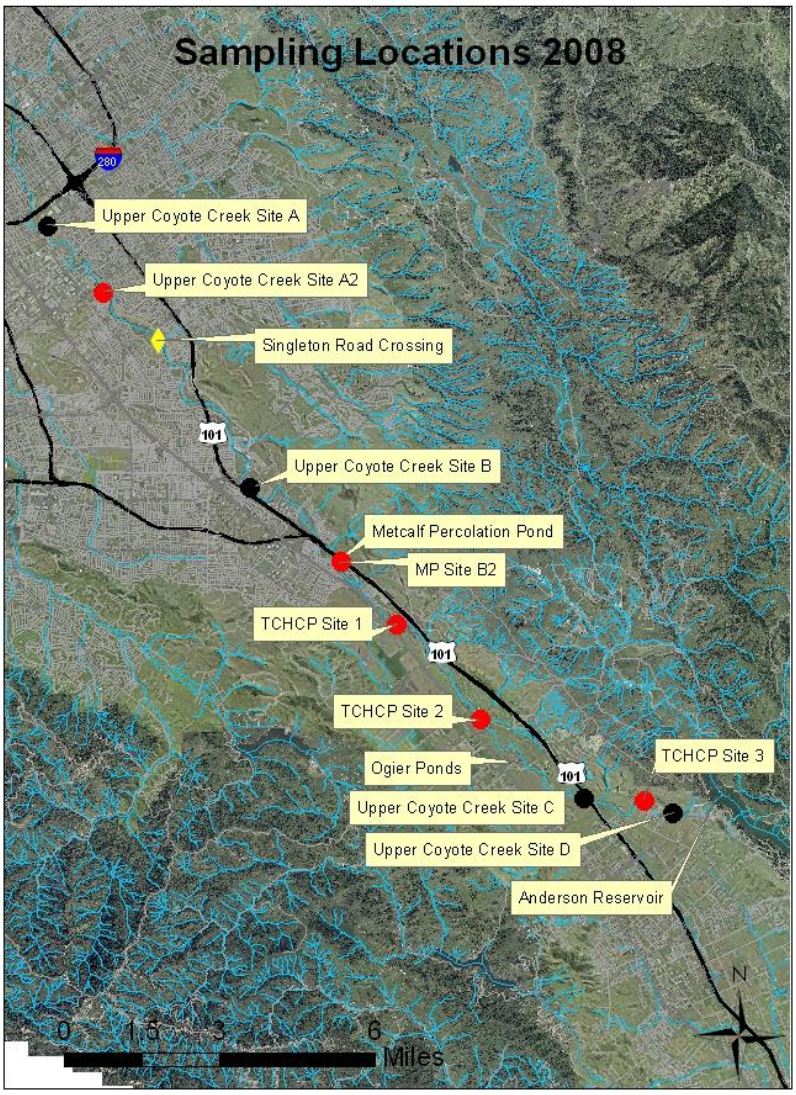


Figure 1. Fish sampling sites in the Upper Coyote Creek Watershed. New sites added to the baseline fisheries investigation in 2008 are depicted in red. Singleton Road fish barrier evaluation site is depicted in yellow.

To further understand the fisheries resources in Coyote Creek, this study aims to collect and compile basic information regarding population status and structure. Various metrics were chosen to evaluate fish community composition. The objectives of this investigation are to determine the existing conditions for native fish in the project reach; identify community assemblages, evaluate taxonomic composition and spatial distribution of fishes; determine the abundance, density, age and size structure of native fish; ascertain the proportion of exotic taxa utilizing the project reach; and evaluate temporal, partial or total

barriers to anadromous fish migration in the project reach, Upper Penitencia Creek and upstream of the project reach on the mainstem of Coyote Creek.

Upper Penitencia Creek

Upper Penitencia was initially included in the Mid-Coyote baseline fisheries assessment because of its confluence point with Coyote Creek in the project reach. In addition, habitat conditions are considerably better in this tributary than the mainstem of Coyote Creek for native fish including spawning and rearing steelhead (Stillwater Sciences, 2006). Information regarding dryback zones, water operations and temperature in Upper Penitencia were included in this report since these instream conditions affect abundance and distribution of fish within Upper Penitencia Creek.

The Upper Penitencia Creek watershed drains an area of 24 square miles with the headwaters originating in the eastern Diablo Mountain Range. Natural springs and tributaries contribute to the perennial flow in the watershed. However, downstream flows are also affected by Cherry Flat Reservoir. The reservoir is owned by the City of San Jose and was constructed in 1936 for flood control. The drainage area for the reservoir is 2.41 square miles and the earthen dam has a capacity of 500 acre feet (DWR, 2009). Flow releases from the reservoir are not currently monitored or scheduled (BRG, 2001). Flows in spring of 2007 and 2008 were limited from the reservoir presumably due to the arid conditions in Santa Clara County.

Penitencia Creek percolation ponds are located on the historic alluvial fan which is the principal groundwater hydrologic unit on the east side of the Santa Clara Valley Basin. The Upper Penitencia Creek alluvial fan merges laterally with smaller fans to the northwest and southwest (Iwamura, 1977). The primary source of water for the Penitencia ponds is imported from the South Bay Aqueduct pipeline. Water is also diverted from Upper Penitencia Creek at Noble and Mabury fish ladders to the percolation ponds from November 1-June 1. Diversions at the Noble fishway are not only based on the time of the year, but on the availability of water in the creek. There needs to be enough flow in the creek to accommodate the diversion and provide continuous flow to keep a live stream to the confluence with Coyote Creek. Water is not diverted at Mabury during the winter months when the dam is removed due to limited channel capacity. Water that does get diverted at Mabury is typically imported water that is released upstream of the percolation ponds to recharge the groundwater aquifers. The instream discharge point for the imported water is approximately 3.4 miles upstream of the confluence with Coyote Creek. Accreted flow from the perched aquifer also contributes water to the channel before the confluence point and fourteen outfalls contribute runoff to the creek within the percolation zone. The winter percolation rate in the channel is approximately 2.5 cfs per day while the daily summer percolation rate is 3.5 cfs per day (Bozzo, pers. communication, 2009).

Upper Penitencia Creek experienced areas of dryback in 2007 and 2008 in areas where natural percolation rates are high. The creek had discontinuous flow from the lower portion of Alum Rock Park to the release point for imported water located adjacent to the Penitencia Percolation Ponds (Photograph A&B). Sampling site B is located in the dryback zone while sampling Site A is within the wetted parameters of the percolation zone (Figure 2).

Photographs A and B. A) Imported water entering Upper Penitencia Creek adjacent to percolation ponds B) Upper Penitencia Creek at Alum Rock Park in the dryback zone.

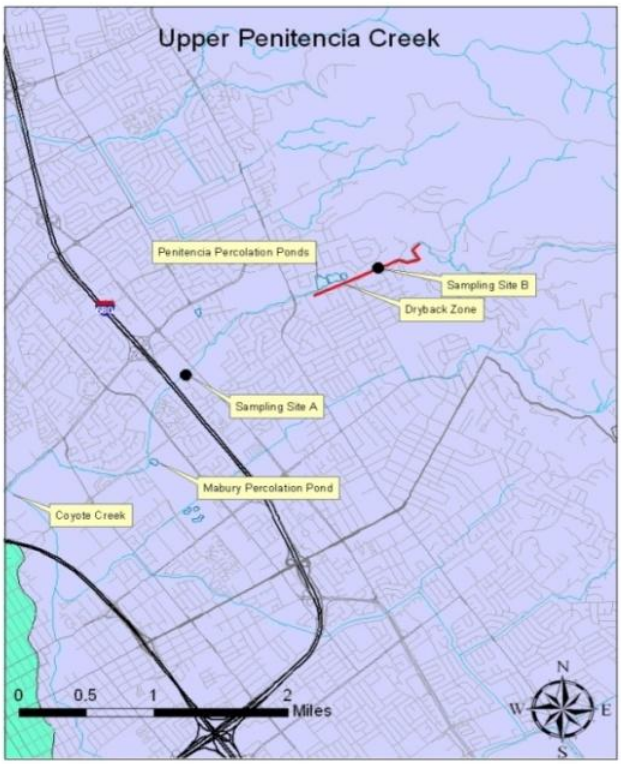


Figure 2. Location of sampling sites on Upper Penitencia Creek for the baseline fisheries study and percolation pond sites. Dryback zone during the 2007-2008 season is depicted in red.

Fish Passage Assessment 2008

The first suspected physical barrier upstream of the Mid-Coyote Creek project limits at Singleton Road was selected to be assessed as a potential fish passage impediment for year two of the survey. The entire project reach (6.1 miles) was surveyed in the low flow season of 2007 and 2008 to find fish passage

impediments within the project limits. Except for the culvert indentified in the 2007-08 report at the confluence with Upper Penitencia Creek, no other passage impediments for anadromous fish were identified in the 6.1 mile project reach.

Singleton road crossing is located approximately 4.7 miles upstream of Interstate 280 on the mainstem of Coyote Creek (Figure 1). The road is owned and maintained by the City of San Jose. Singleton Road was chosen for further evaluation because it is a stream crossing that constricts the natural channel width and is not in alignment with the stream channel (Photographs C-F). The site also has projecting culverts which result in an entry leap for migrating fish as well as debris accumulation within one culvert inlet. There are approximately 17.8 miles of stream above the road crossing to the base of Anderson Reservoir.

Photographs C-F. C) Side view of Singleton Road culverts, D) Top view of Singleton Road culverts, E) Debris blockage located in left culvert (looking downstream) F) Singleton Road during a high flow event, February 2003.

Methods

Site Selection

Thirteen fish sampling stations were established within the 6.1 mile project limit in 2007(Figure 3) (Table 1). One additional sampling location was established downstream of the project reach in 2008. Project reaches were divided into 200 foot segments and the sampling site was selected based on randomly generated numbers within each reach. All sampling sites were a minimum of 200 linear feet in length or greater depending on blocknet placement to adequately isolate the sampling area. Private property access prohibited sampling at the randomly selected station in Reach 13. This Reach is comprised entirely of mid-channel pool; therefore, the first site with access to the creek upstream of the private property with similar habitat was selected. This site is reported as sampling site 12 located at William Street Park (Figure 3). Sampling Site 5 was not sampled during the 2008 season due to the presence of a large homeless encampment. It is anticipated that Site 5 will be sampled again in 2009. A total of 2713 linear feet were sampled in 2008. This also included the new site downstream of Montague Expressway.

The project limits were habitat typed prior to fish sampling in the summer of 2006 (Entrix 2006). Physical habitat measurements (i.e. mean depth, width and length); instream cover (amount and complexity); canopy cover; and substrate characteristics are detailed in the Baseline Fisheries Habitat Study Report (Entrix, 2006) but are not summarized in this document. During the baseline fisheries investigation, the principle investigator verified the 2006 habitat types by measuring the linear distance of each habitat unit with a hip chain. Maximum pool depths and widths were also determined with a stadia rod and hip chain.

Additional sampling sites were established in 2007 on each of the tributaries that have confluence points within the project boundaries. All sites were measured in linear feet and habitat typed using the same methodology described in the Entrix 2006 report. The first two sites are located on Upper Penitencia Creek, Site A downstream of Capital Expressway and Site B located upstream of Noble Avenue (Figure 2). A total of 829 linear feet of stream was sampled in Upper Penitencia in 2008. The second tributary, Lower Silver Creek, sampling Site A is located upstream of the confluence with Coyote Creek. A total of 200 linear feet of stream was sampled in Lower Silver Creek in 2008.

Eight additional sampling sites, for a total of 1695 linear feet, were established upstream of the project limits on the mainstem of Coyote Creek to reference conditions outside of the project boundaries on the valley floor (Figure 1). Similar to the project reach locations, each site was a minimum of 200 linear feet. In addition, the Metcalf Percolation Pond (MP Site B2) was also sampled in 2008. All sites were measured in linear feet and habitat typed using the same methodology described in the Entrix 2006 report. Five of these sites were chosen to correspond with sites sampled by Pitt and Bozeman (1982) and SCVURPPP (2001). Site A2 was added in 2008 to correspond with the SCVURPPP macroinvertebrate sampling site. Three new sampling locations (TCHCP1, 2 and 3) were chosen to correspond with the proposed management zone for steelhead downstream of Anderson Reservoir.

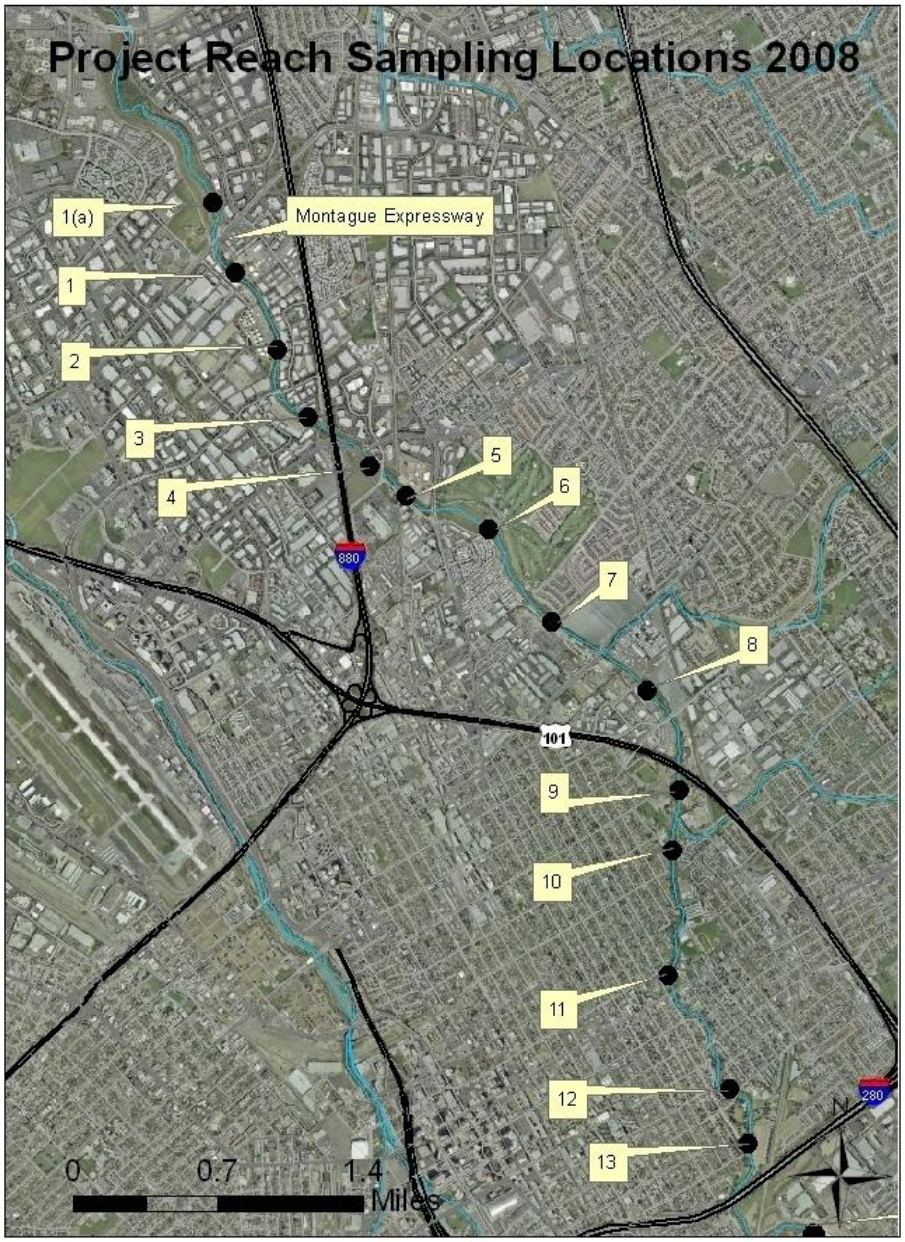


Figure 3. Fish sampling sites within the Mid-Coyote Creek project reach from Montague Expressway to Interstate 280.

The SCVURPPP report identified sites on the mainstem of Coyote Creek that fell into three classifications based on land use composition within the drainage area. Urban sites were the most impacted and had the highest percent of impervious surfaces within the drainage area. Transition sites had

been recently transformed (1979) from rural to urban based on previously collected data examined by the SCVURPP researchers. Sites classified as rural were downstream of Anderson Reservoir and were considered the least impacted by surrounding land use. With regards to this study, Upper Coyote Creek Sites A and A2 falls within SCVURPPP's urban classification zone while Sites B and MP B2 falls within the transition zone. Sites TCHCP sites 1, 2, 3 and Upper Coyote Creek sites C and D correspond to the rural zone of Coyote Creek downstream of Anderson Reservoir (SCVURPPP, 2001).

Table 1. Site identification number, location, date sampled and length of each sampling unit.

Sampling Site ID	Location	Date Sampled	Length of Sampling Unit (ft)
#1(a)	Downstream Montague Expressway	May 14,2008	**203**
#1	Upstream Montague Expressway	May 8, 2008	**200**
#2	Downstream Charcot Avenue	May 7,2008	**205**
#3	Upstream Charcot Avenue	May 8,2008	**210**
#4	Upstream Interstate 880	May 26,2008	**207**
#5	Downstream Old Oakland Road	Did not sample in 2008	**0**
#6	Upstream Old Oakland Road	May 6, 2008	**244**
#7	Downstream Berryessa Road	May 7,2008	**213**
#8	Downstream Mabury Road	May 15, 2008	**211**
#9	Upstream Mabury Road	May 27,2008	**210**
#10	Upstream of Highway 101	May 1,2008	**200**
#11	Downstream E. Santa Clara Street	May 13,2008	**210**
#12	Upstream E. William Street	May 5,2008	**200**
#13	Downstream Interstate 280	May 5,2008	**200**
Upper Coyote Creek Site A	Upstream Interstate 280	May 22, 2008	**204**
Upper Coyote Creek Site A1	Upstream of Tully Road	May 13,2008	**210**
Upper Coyote Creek Site B	Upstream Ford Road	May 22, 2007	**200**

Sampling Site ID	Location	Date Sampled	Length of Sampling Unit (ft)
Three Creeks HCP Site 1	Upstream of Coyote Ranch Road	April 22, 2008	**210**
Three Creeks HCP Site 2	Upstream of Coyote Golf Drive	May 6, 2008	**220**
Upper Coyote Creek Site C	Upstream Ogier Ponds at Highway 101	May 12, 2008	**212**
Three Creeks HCP Site 3	Adjacent to Santa Clara County Ranger Station	May 7, 2008	**234**
Upper Coyote Creek Site D	Downstream Anderson Reservoir	May 7,2008	**205**
Upper Penitencia Site A	Upstream Interstate 680	June 4, 2008	**625**
Upper Penitencia Site B	Noble Fish Ladder	May 15, 2008	**204**
Lower Silver Site A	Downstream Highway 101	May 1, 2008	**200**

Fish Sampling

Sites were quantitatively sampled using blocknets to isolate fish within the sampling limits. Two types of electrofishers were employed during the course of the survey. Site conditions were evaluated prior to commencement of field sampling to determine which electrofishing gear was site appropriate. A Smith-Root Inc. Streambank Generator Powered Pulsator (5.0) electrofishing system with a floating tote barge was utilized at the deeper, wider sites which required more than one anode pole to effectively fish. A Smith-Root Inc. battery operated backpack (12B) unit was used at sites were the stream width was less than 15 feet wide and could be effectively fished with one anode pole and two netters.

Prior to each electrofishing session, stream conductivity and temperature measurements were taken and the electrofisher unit settings were adjusted accordingly to minimize damage or mortality to fish encountered. Other water quality parameters measured prior to sampling included ph, turbidity, and dissolved oxygen. A mutli-parameter U-10 Horiba® water quality meter was used for all the measurements and was calibrated daily before use.

Multipass electrofishing removal methods were utilized with equal effort applied to each sampling pass. Electrofishing was conducted in an upstream manner at each site. Electrofishing time was quantified in seconds for each pass through the sampling unit. Each pass represented a sampling period. Fish captured during each sampling period were relocated outside of the isolated sampling area to avoid recapture. Three passes were made at each site. At the conclusion of each pass, captured fish were identified, measured and each fish was checked for abnormalities (i.e. lesions, deformities).

Population Estimates

Population estimates were calculated for fish within each sampling unit using multipass depletion methods (Lockwood, 2000). Capture data at each sampling site was entered in Microfish 3.0, a program designed for use with depletion data to give maximum likelihood population estimates (Van Deventer and Platts, 1985). The program estimates density, standard error and degree of fit to the model (i.e. catch efficiency or capture probability). This parameter corresponds to the probability that a member of the population will be captured.

Fish that were difficult to capture and had poor depletion numbers, (i.e. Pacific lamprey-*E.tridentatus*) were not included in the analysis but were reported as total catch per sampling unit.

Fish sampling commenced April 22 and ended June 4, 2008. A summary of dates sampled, location, and the length of each unit sampled are presented in Table 1.

The population results are summarized in this annual report but no further data analysis will occur until year three of the sampling is complete. After year three, the population data and habitat variables collected (i.e. discharge, water temperature, conductivity, percent cover etc.) at each of the sites will be incorporated into a statistical analysis to determine if there is a correlation between fish assemblages and environmental variables within the study area. This analysis will help determine what habitat variables favor native versus introduced fish assemblages and determine what effects the annual fluctuations of flow have on fish communities.

Length Frequency Histograms

Length-frequency histograms were graphed to assist in determining age and size structure of native fish within the project footprint. Catch rates were frequently low for 2007 and 2008 therefore the histograms had unimodal distribution which made it difficult to determine year class structure. Scale analysis has been incorporated into sampling efforts for this program to further elucidate age structure.

The width of the length groups for the histograms is based on the maximum fish length. A 1.0 cm interval was used for species that reach 30 cm. A 2.0 cm interval was used for species that reach 50 cm.

Fish Barrier Assessment at Singleton Road

A topographic survey of both culverts, located at the Singleton Road crossing on Coyote Creek, was performed in January 2009. Information collected at the culverts included: culvert shape and dimensions, material and corrugation, roughness of culvert material, distance culverts were perched off of the water surface, culvert length, and inlet and outlet elevations for both culverts using a survey level. Elevation and horizontal data was measured to within two hundredths of a foot. In addition to the longitudinal profile for both culverts, a cross-sectional survey across the bankfull channel width at the downstream tailwater control was preformed to increase the accuracy of the passage analysis.

The physical data described above and additional species-specific information for Pacific lamprey and rainbow trout (*O. mykiss*) which included mean discharge values during migration, minimum water depth requirements, and swimming abilities were entered into the FishXing® software to determine the culvert's impact to anadromous fish passage. Flow data was evaluated from 3-500 cubic feet per second

to determine a passable flow range based on pipe dimensions and species specific swimming capabilities. The stream gauge at Endenvale details average base flows upstream of this site range from 3-6 cfs (Figure 6).

Biological criterion for adult rainbow trout was referenced from the CDFG Fish Passage Evaluation at Stream Crossings Manual Part IX(2003). Fish length for adult rainbow trout was based on the fork length of an adult fish captured at the Upper Penitencia Creek Sampling Site B during the 2007 sampling. Out-migrant trout length was based on the average fork length of fish captured during out-migrant trapping operations on Coyote Creek (SCVWD, 2002). A low passage design flow of 3.0 cfs was chosen to evaluate fish passage during low flows because during migration seasons the creek typically will have a minimum of 3.0 cfs passing through the culverts. A high passage flow of 500 cfs was chosen because that is the estimated bankfull discharge at this location.

Fish passage at the culverts was also evaluated for adult lamprey. The length of adult lamprey was based on the average total length of the adults captured during the baseline fisheries monitoring in 2007 and 2008. Swimming performance criteria for adult Pacific lamprey was taken from Mesa et al. 2003. Due to the role that attachment of the suctorial disc plays in upstream movement of lamprey, minimum depth requirement data was difficult to obtain. For the purposes of this analysis, a depth requirement of 0.3 ft was chosen as a minimum for upstream movement.

Hydrological Conditions

To evaluate changes in flow regimes in the sampling area, total monthly precipitation and stream flow gauging data are graphed. Rainfall records are summarized for the last three water years prior to fisheries monitoring. However, it should be noted that base flows for the 2006/07 water year were lower than average due to limited rainfall. For water year 2007/08 rainfall totals were closer to average however runoff totals were lower due to the pattern of precipitation and low reservoir levels (Western Weather Group, 2008) (SCVWD, 2009).

Stream flow within the project reach and the mainstem of Coyote Creek downstream of Anderson Reservoir vary considerably. Flow was calculated prior to each sampling session using a width/depth transect, where current water velocity was measured from 60% of the stream depth with a handheld Marsh-McBirney Flowmate 2000® meter.

Daily discharge within the project reach is influenced by two tributaries: Upper Penitencia Creek and Lower Silver Creek. The Lower Silver Creek watershed is 43 square miles with 11 tributaries. Some of the tributaries are perennial in the headwaters. In addition to the two tributaries contributing flow to the project reach, 44 outfalls drain directly to the creek within the project boundaries. Thirty of these outfalls are owned and operated by the City of San Jose and range in size from 18-72 inches in diameter with a combined drainage area of 3,341 acres (SCVWD, 2007). Mean daily discharge through the project reach from the confluence of Lower Silver Creek downstream to Montague Expressway is best represented by the USGS stream gauge located at Highway 237 in Milpitas. A hydrograph of the mean daily discharge at the location is reported in the results for water year 2007/08.

Base flows are lower upstream of the confluence point with Lower Silver Creek and the closest representative stream gauge, located at Edenvale Road, is approximately 5.6 miles upstream of the project reach. This District owned stream gauge is located upstream of the Upper Silver Creek confluence point

so the discharge from this watershed is not fully accounted for. A hydrograph of the mean daily discharge at the location is reported for water year 2007/08 in the results.

Stream flow for the Upper Coyote Creek sampling Sites TCHCP Sites 1, 2, 3 and Sites C and D are best denoted by District stream gauge 82 located approximately 1.5 miles downstream of Anderson Reservoir. A hydrograph of the mean daily discharge at this location is reported for water year 2007/08 in the results. The Coyote Canal was not operated in water year 2007/08 and water was not diverted out of the main channel into this facility.

For Upper Penitencia Creek and Lower Silver Creek sampling sites, manual discharge data was taken prior to fish monitoring and is reported in the results.

Temperature Monitoring

Onset Computer Corporation HOBO® Temperature Monitors were deployed at half mile increments throughout the project reach. Fourteen temperature monitoring stations were established in 2005 (Table 2). The temperature loggers were programmed to record water temperature every hour to capture the range of daily temperature fluctuations within the stream. Two temperature loggers were deployed at each station in the event of monitor failure. The temperature loggers were placed in protective casings and secured to the bank with cable. The loggers were allowed to sink to the bottom of the creek away from direct solar radiation which could artificially influence the temperature reading. A summary of deployment/retrieval dates and results from each the monitoring location for 2008 are presented in the results. No further data analysis will occur until year three of the sampling is complete.

Table 2. Summary of temperature recorder station identification numbers with location and project reach number.

Temperature Logger Station ID	Location	Project Reach Number
1	Downstream Montague Expressway	4a
2	Downstream Charcot Avenue	4b
3	Downstream O' Toole	5
4	Upstream Ridder Park Drive	7
5	Upstream Old Oakland Road	8a
6	Downstream Berryessa Road	8b
7	Upstream Berryessa Road	9
8	Upstream Mabury Road	10
9	Downstream East Julian Street	11
10	Downstream East Santa Clara Street	12
11	Downstream East San Antonio Street	13
12	Upstream East William Street	14
13	Upstream Interstate 280	n/a
14	Lower Silver Creek upstream of confluence with Coyote Creek	n/a

Results

A total of twenty-four sites were sampled within the Coyote Creek watershed in 2008. The total number of fish captured at each site ranged from 4 at sampling sites Upper Coyote Creek A and A1 to 325 at Upper Penitencia Creek Site A. Overall, sixteen species of fish were captured within the study area. Eight of the sixteen species were native to the watershed while the remaining eight species were introduced (Table 3).

Table 3. Common and scientific names of fishes collected in the Coyote Creek watershed during the 2008 fisheries study.

Species ID*	Species	Common Name	Origin
SSKR	*Catostomus occidentalis*	Sacramento sucker	N
SHRT	*Oncorhynchus mykiss*	Steelhead/rainbow trout	N
RCH	*Lavinia symmetricus*	California Roach	N
PSCP	*Cottus asper*	Prickly sculpin	N
TP	*Hysterocarpus traski*	Tule perch	N
STK	*Gasterosteus aculeatus*	Threespine stickleback	N
H	*Lavinia exilicauda*	Hitch	N
PL	*Entosphenus tridentatus*	Pacific Lamprey	N
RS	*Cyprinella lutrensis*	Red shiner	I
FHM	*Pimephales promelas*	Fathead minnow	I
CP	*Cyprinus carpio*	Common carp	I
LMB	*Micropterus salmoides*	Largemouth bass	I
BG	*Lepomis macrochirus*	Bluegill	I
GS	*Notomigonus chrysoleucas*	Golden shiner	I
GF	*Carassius auratus*	Goldfish	I
MOS	*Gambusia affinis*	Mosquitofish	I

Note: Origin codes: N = native, I = introduced.

*Species codes were used to simplify tables and graphs for the results section.

Rainfall totals when the fish sampling began in May were close to average for San Jose however runoff in the streams was minimal due to the pattern of precipitation and low reservoirs above the project limits. Monthly precipitation totals are shown in Figure 4 for the three water years prior to the onset of this study.

The fish sampling results are summarized below in three sections based on their location within the study area. Section 1 displays the results within the project reaches from site 1(a) downstream of Montague Expressway to Interstate 280 (sites # 1(a)-13). Section 2 provides results for the eight reference sites selected upstream of the project reach, Upper Coyote Creek (UCC) sites A-D and Three Creeks HCP Sites 1-3. Information in both of these sections includes: hydrographs; types of habitat units sampled; total number of each species captured; population estimates for each sampling site; and water quality results at each sampling station. In addition, the results of the fish passage analysis for the culvert pipes at Singleton Road on Coyote Creek are reported for adult and juvenile trout and adult Pacific lamprey.

Section 3 provides results for the two tributaries, Upper Penitencia Creek (Sites A and B) and Lower Silver Creek (Site A). Linear feet of each habitat unit surveyed, number of each fish species captured and

water quality results are reported for each site. The results of the temperature monitoring stations are reported for 2008. These results will be analyzed along with year two and three findings of the study and summarized in the final report in 2009.

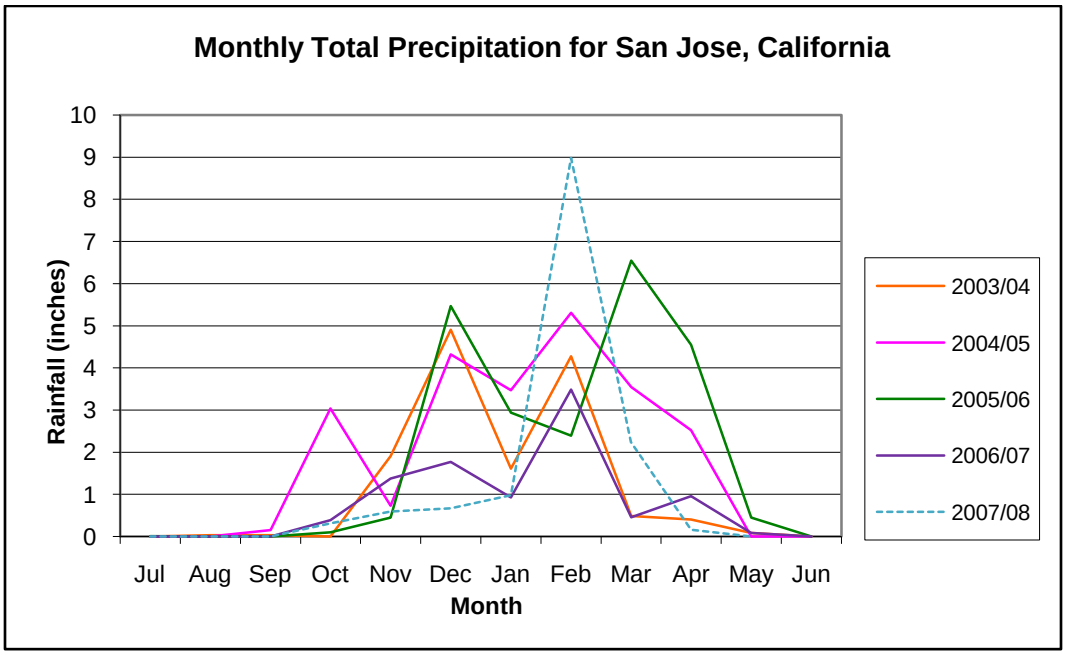


Figure 4. Monthly total precipitation for San Jose, California for water year 2003 -2008**.**

Section 1-Flood Protection Project Area (Sampling Sites 1(a)-13)

Hydrographs

Mean daily discharge for sampling sites 1(a)-11, from downstream of Montague Expressway to the confluence with Lower Silver Creek, are depicted by the USGS gauge located at Highway 237 in Figure 5. Mean daily discharge for sampling sites 12 and 13, Coyote Creek upstream of the confluence with Lower Silver to Interstate 280, are depicted by the Edenvale gauge in Figure 6. Manual discharge measurements taken at each sampling site are reported in Table 4. The base flow is considerably lower at the Edenvale gauge and consequently the last two fish sampling stations within the flood protection project limits.

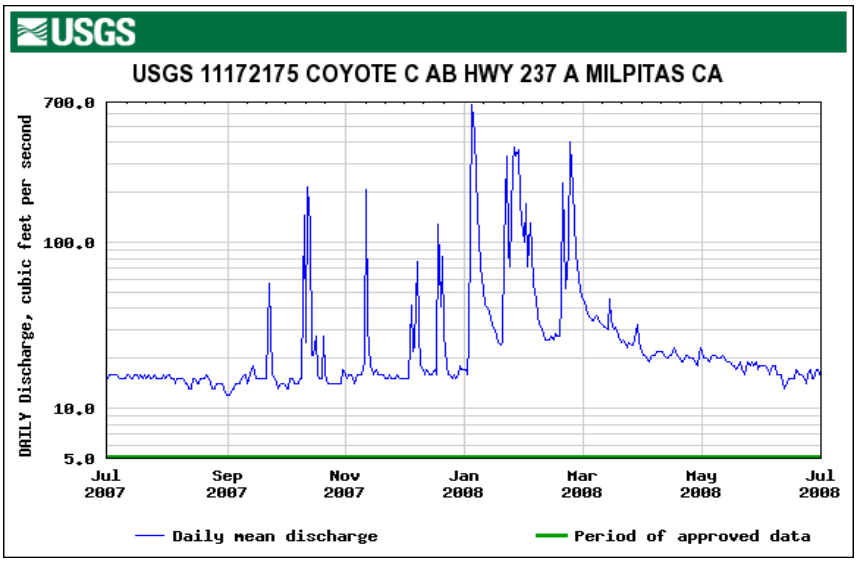


Figure 5. Daily mean discharge for water year 2007-08 measured at USGS gauge at Highway 237 on Coyote Creek in Milpitas.

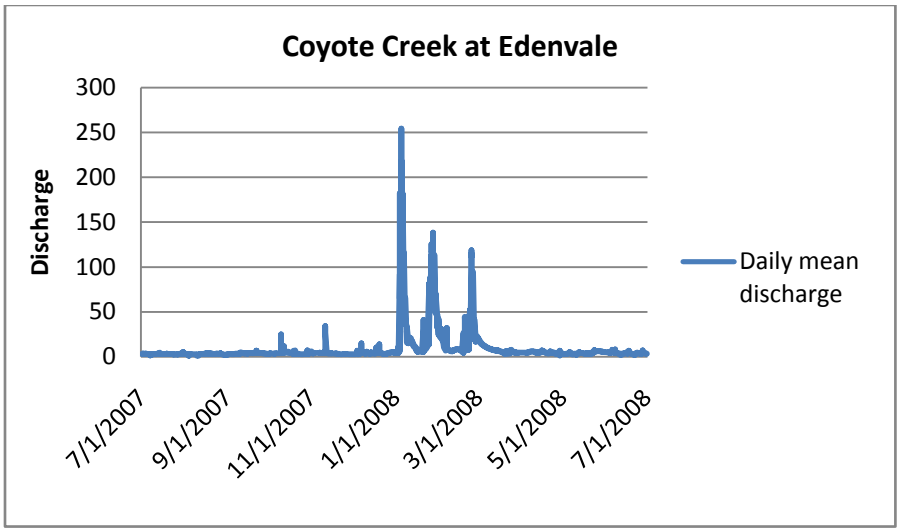


Figure 6. Daily mean discharge for water year 2007-08 measured at Edenvale Gauge on Coyote Creek in San Jose.

Table 4. Manual discharge at sampling sites 1(a)-13.

Site ID	Date	Discharge(cubic feet per second)
1(a)	May 14,2008	19.3
1	May 8, 2008	21.5
2	May 7,2008	21.0
3	May 8,2008	20.9
4	May 26,2008	18.1
5	Did not sample in 2008	n/a
6	May 6, 2008	16.6
7	May 7,2008	16.3
8	May 15, 2008	8.2
9	May 27,2008	20.8
10	May 1,2008	17.3
11	May 13,2008	12.4
12	May 5,2008	4.1
13	May 5,2008	2.8

Habitat Types

The flood control project limits are dominated by pools, particularly mid-channel pools which make up 77.4 % of the total 6.1 miles. Runs, including pool tailouts, are the second most abundant habitat type comprising 15.1 % of the overall project area. Riffles only make up 1.1 % of the flood control project area.

A total of 2713 linear feet of stream was sampled within the flood protection project area during the 2008 sampling season. This equates to an 8.4% sampling effort. Of the 2713 linear feet sampled, 66% were pools (mid-channel and lateral scour), 27% were runs and 7% were riffles (Figure 7). This combination of habitat types provides a representative sample of the larger flood protection project area.

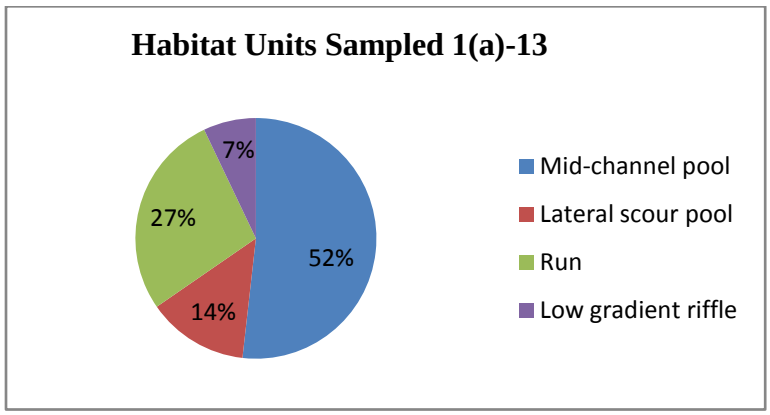


Figure 7. Total linear feet of each habitat type sampled during May 2008 from downstream of Montague Expressway to Interstate 280 on Coyote Creek.

Fish Captured

Thirteen species of fish, representing eight families were captured within the thirteen sampling sites from downstream of Montague Expressway to Interstate 280 in the 2008 sampling season (Figure 8). Seven of the thirteen species captured are native to the Coyote watershed with three of the seven being found in the greatest abundance, Sacramento sucker, California roach, and prickly sculpin. Overall, only 362 fish (native and introduced) were captured in the 2008 sampling season compared to 1048 captures in the 2007 season. In addition, thirteen rainbow trout were captured at two sites within the project reach (Site 6 and 7). Fork lengths ranged from 29-189 mm (Figure 9). Results of the length frequency histograms for California roach, Sacramento sucker, prickly sculpin and rainbow trout make it difficult to determine year class however it is evident that multiple year classes are present for all species (Figures 10-12).

Sacramento sucker was captured at all sites except for the additional sampling site added in 2008 downstream of Montague Expressway, Site 1(a). California roach was captured at all sites except two: Sites 1 and 9 with the greatest abundance being captured at site 7 (16 fish). California roach and hitch are known to hybridize in Coyote Creek and although anal fin ray counts were performed in the field, hybrids may have been classified erroneously as California roach (Moyle, 2002). Only 6 hitch were identified in the 2008 season with the greatest abundance captured at site 1(a) (4 fish). Only 3 Pacific lamprey, two adults and one ammocete, was captured in the project reach in 2008 compared to 63 captured in 2007. Prickly sculpin was the most abundant fish captured in the 2008 season with the majority of fish captured at site 1(a) (65 fish).

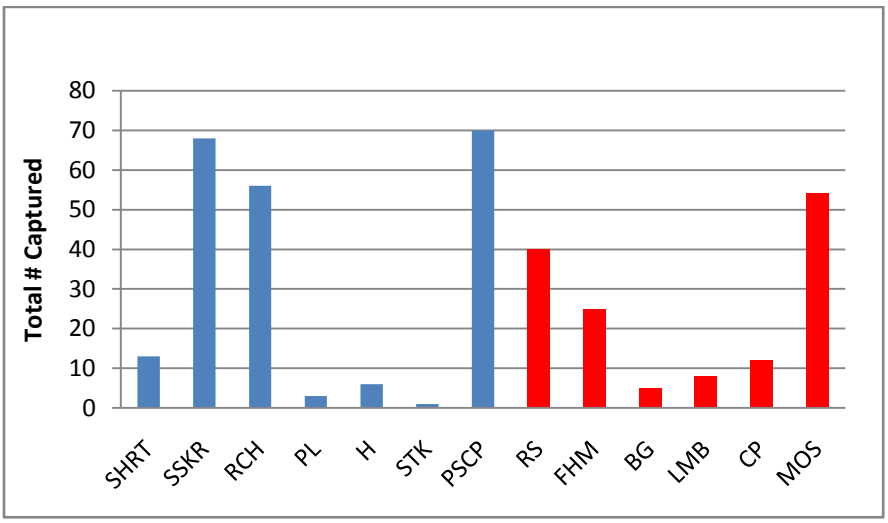
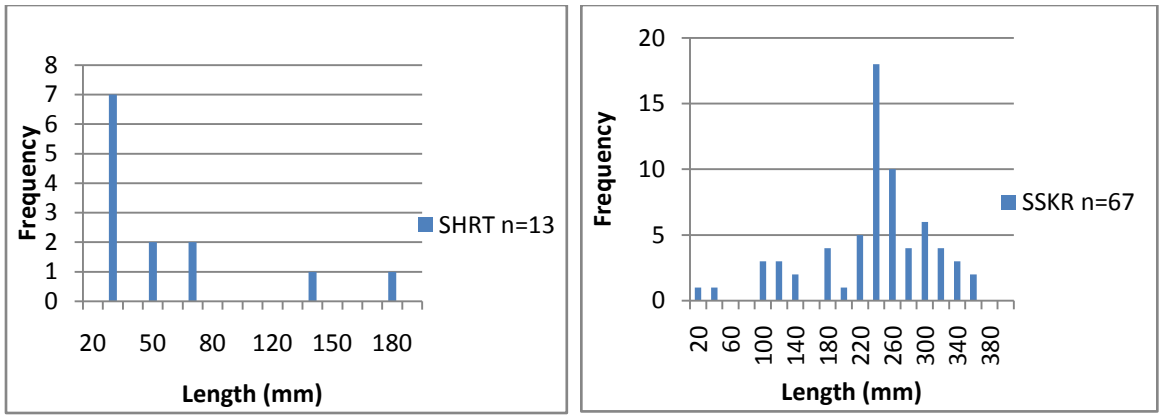
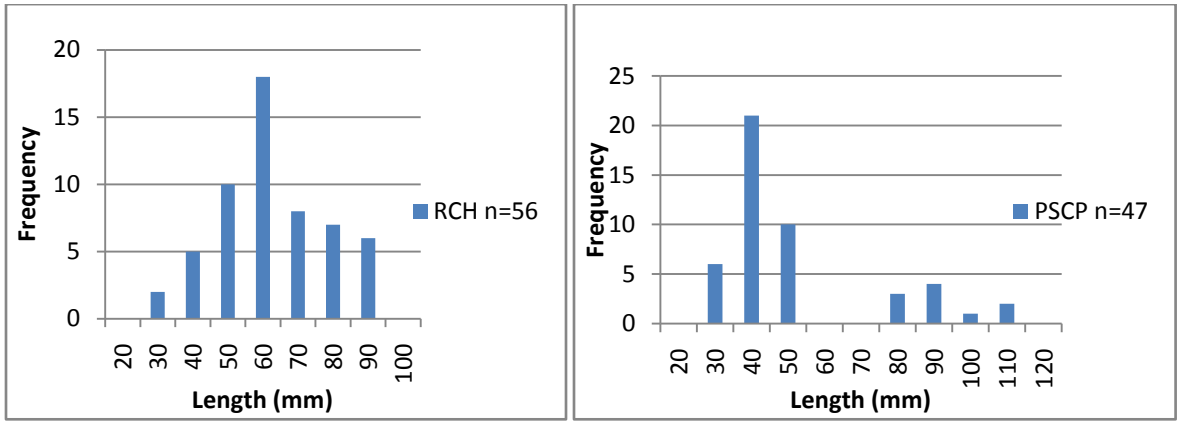


Figure 8. Total number of each species captured from downstream of Montague Expressway to Interstate 280. (Native fish are depicted in blue and introduced fish in red)



Figures 9 and 10. Length frequency histogram for rainbow trout and Sacramento sucker captured at 13 sampling stations in the project reach.



Figures 11 and 12. Length frequency histogram for California roach and prickly sculpin captured at 13 sampling stations in the project reach.

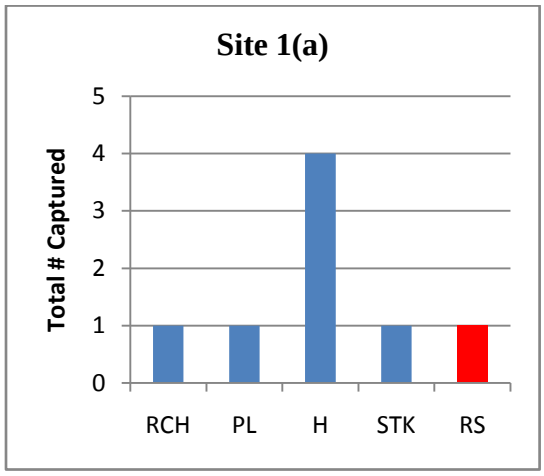
Population Estimates

Maximum likelihood population estimates were calculated based on the multipass depletion method with capture data from each sampling site. For this analysis, each fish captured was partitioned by species and size group. Size group estimates and their variances are summed to provide total population estimates. Population estimate standard error is denoted on the graphs by error bars. The upper and lower confidence interval is also provided for each species.

This method requires that an adequate number of fish be captured on each sampling pass so that measurably fewer fish are available for capture and removal on a subsequent pass. Population estimates were not calculated for fish with poor depletion numbers (i.e. Pacific lamprey, threespine stickleback).

For the 2008 sampling season, capture rates overall were very low and depletion rates were inadequate making population estimates unreliable for some sites and some species. Therefore, sites where species were captured on one pass only or where there was poor depletion numbers these species are reported as total catch. The greatest number of fish was captured at site 1(a) (73 fish) while the fewest fish captured

was at sites 12 and 13 (5 fish). No population estimates were calculated for Sites 1, 3, 6, 9, 12 and 13 because of the low number of captures and poor depletion rates. The results for these sites include total catch only. Native fish are depicted in blue on all graphs; introduced fish are depicted in red. Standard error bars are denoted on all population estimate graphs along with the upper and lower confidence intervals.



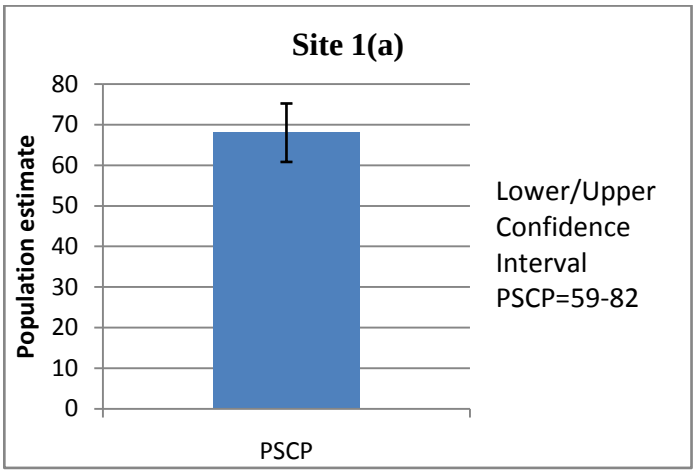


Figure 13. Total catch reported for Site 1(a). **Figure 14.** Population estimate for prickly sculpin at Site 1(a).

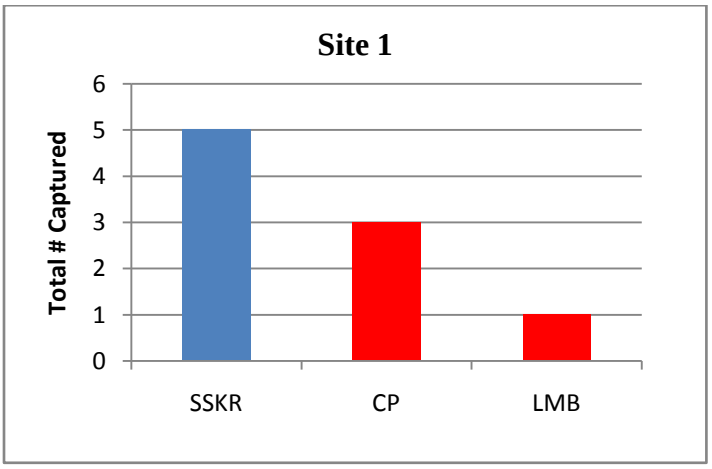
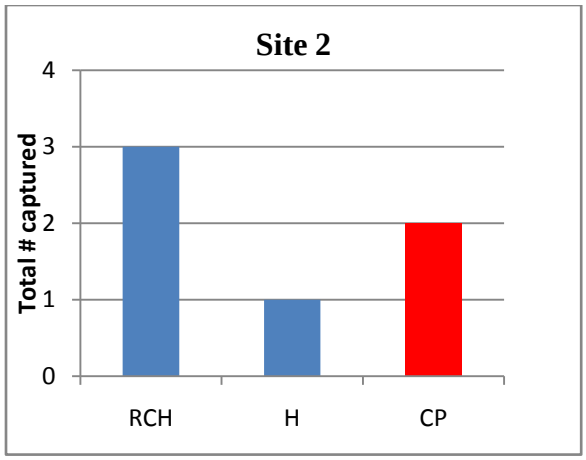


Figure 15. Total catch reported for sampling Site 1.



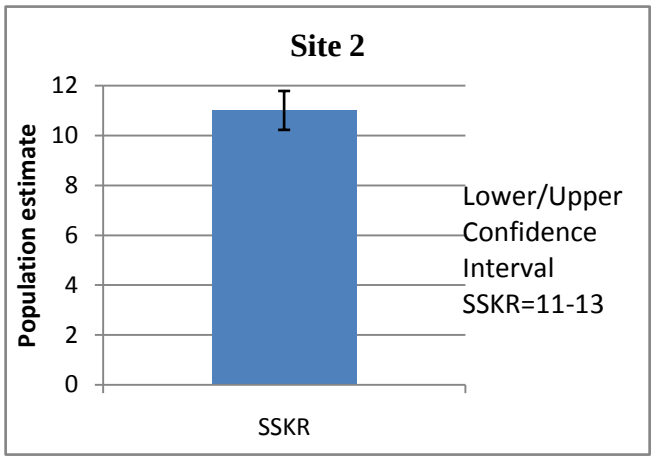


Figure 16. Total catch reported for Site 2. **Figure 17.** Population estimate for Sacramento sucker at Site 2.

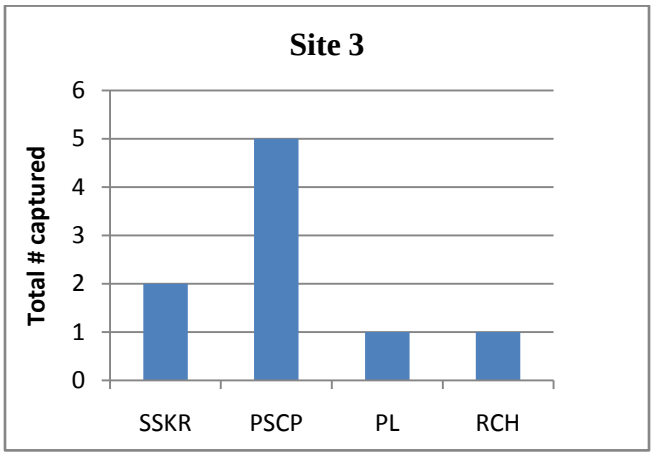
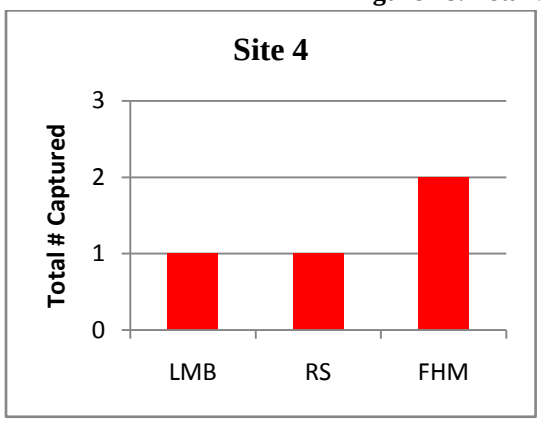


Figure 18. Total catch reported for sampling Site 3.



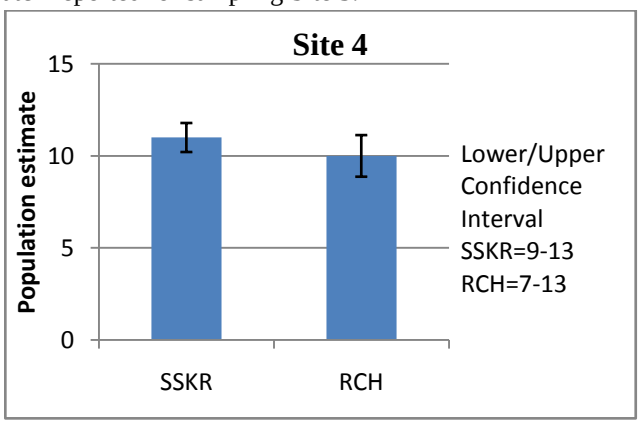


Figure 19. Total catch reported for Site 4. **Figure 20**. Population estimate for Sacramento sucker and California roach at Site 4.

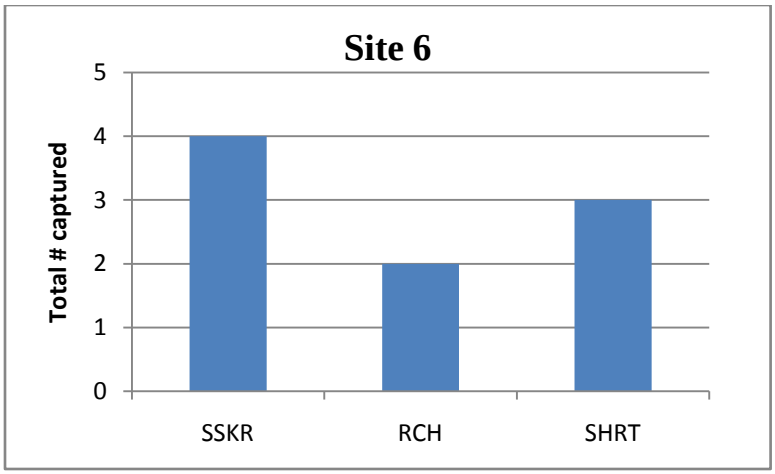


Figure 21. Total catch reported for sampling Site 6.

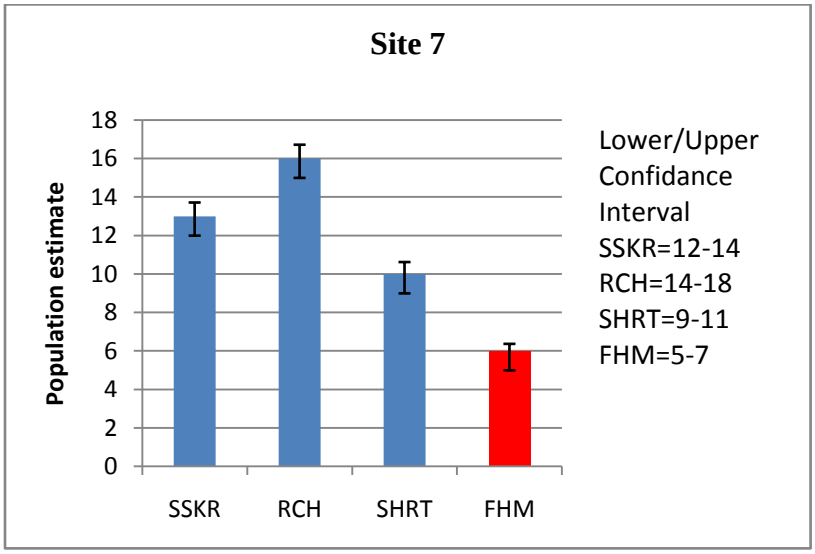
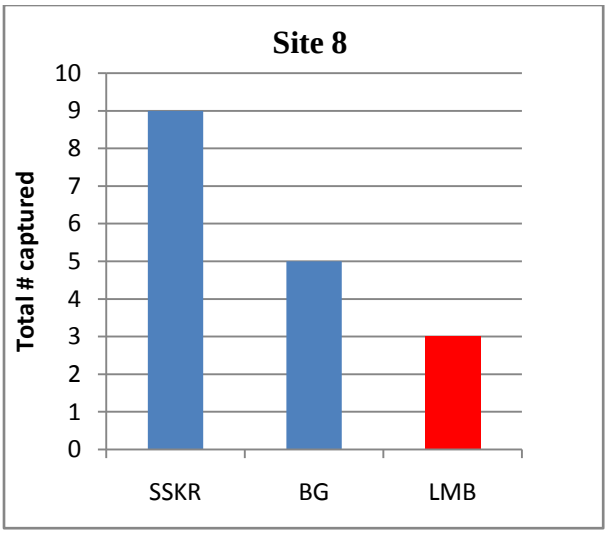


Figure 22. Population estimates reported for Sacramento sucker, roach, rainbow trout and fathead minnow for Site 7.



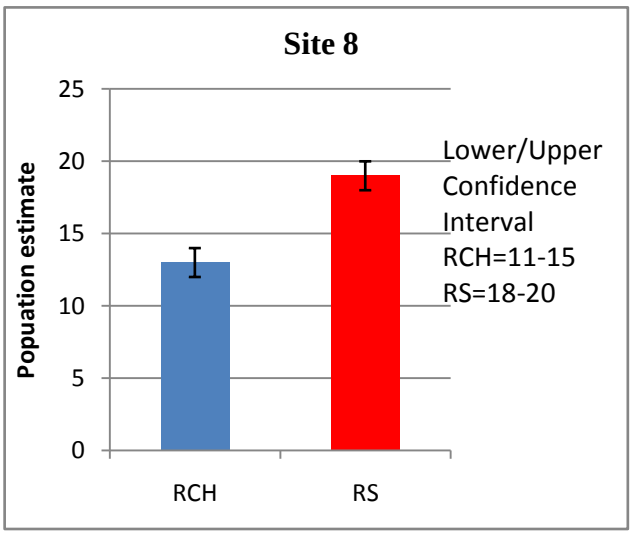


Figure 23. Total catch reported for Site 8. **Figure 24**. Population estimate for California roach and red shiner at Site 8.

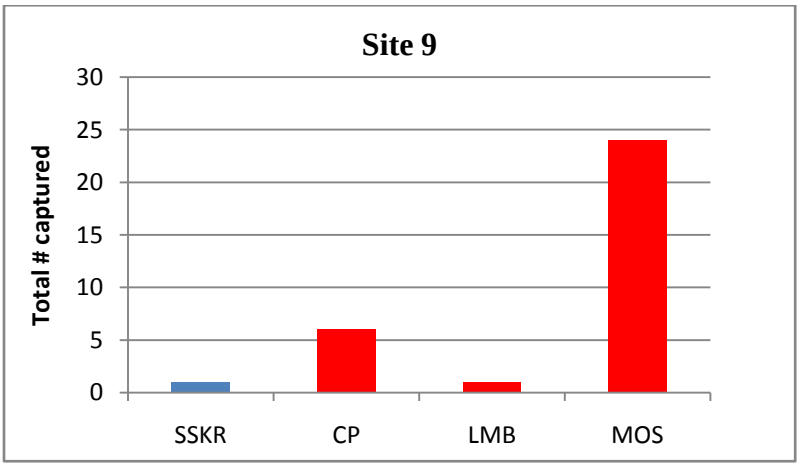
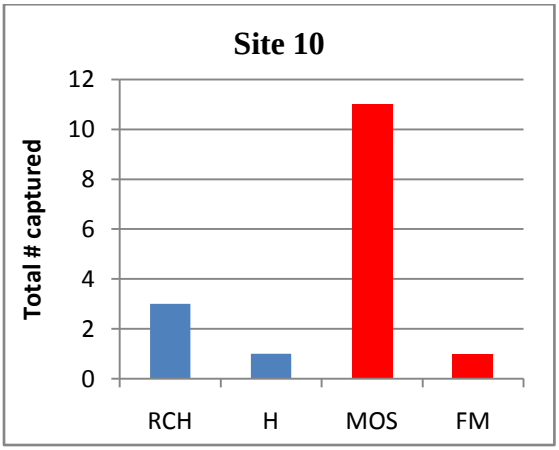


Figure 25. Total catch reported for sampling Site 9.



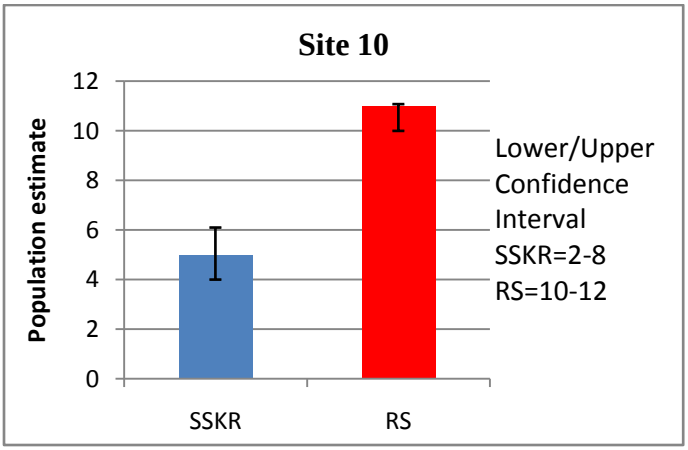
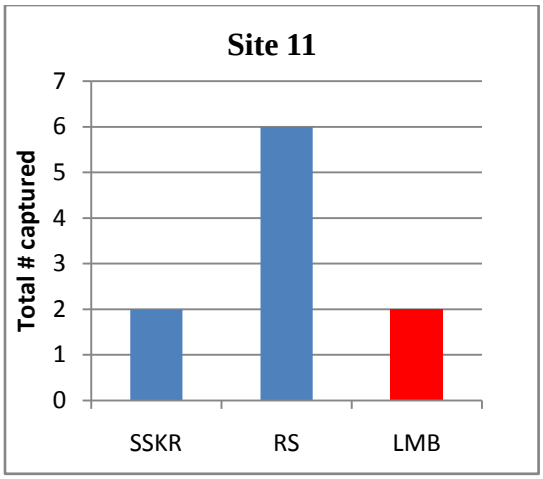


Figure 26. Total catch reported for Site 10. **Figure 27.** Population estimate for Sacramento sucker and red shiner at Site 10.



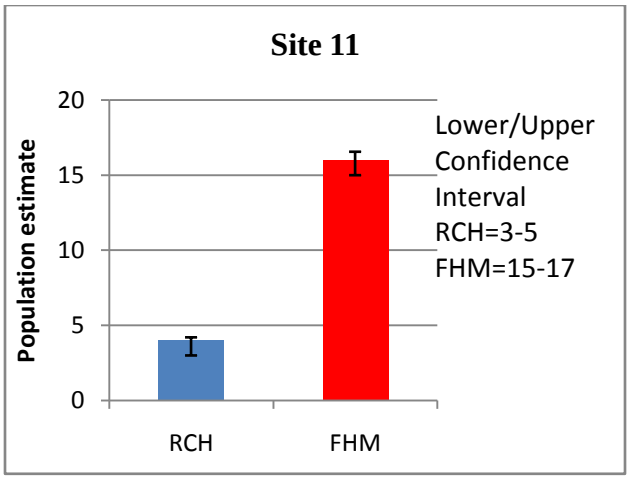
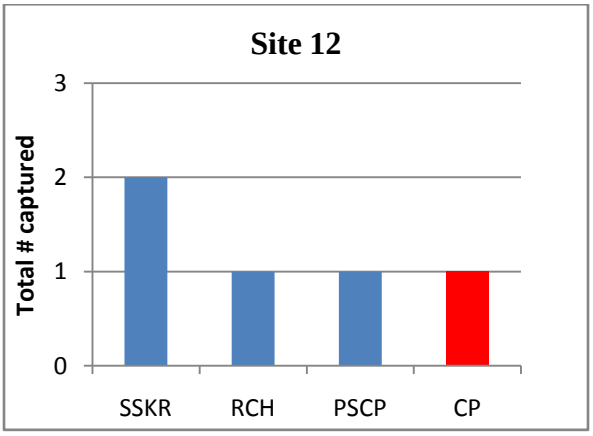


Figure 28. Total catch reported for Site 11. **Figure 29.** Population estimate for California roach and fathead minnow at Site 11.



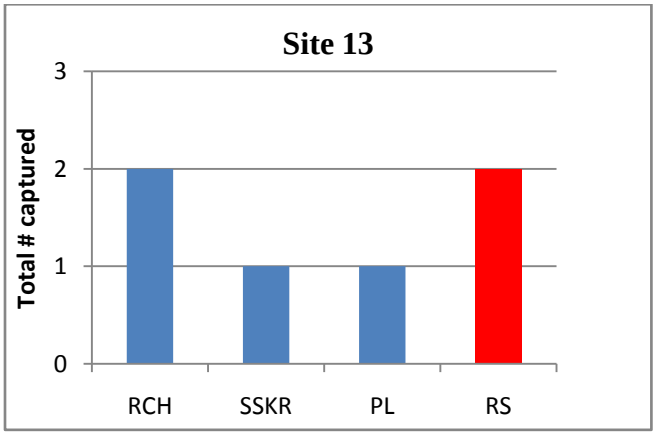


Figure 30. Total catch reported for sampling Sites 12 and 13.

Water Quality Sampling

Water quality parameters were recorded at each sampling site prior to electrofishing activities (Table 5). All sites had sufficient dissolved oxygen levels to support aquatic life. Diel fluctuations in water temperature are recorded by the temperature loggers however instantaneous water temperature was taken prior to sampling. Water temperatures ranged within the project limits from 15.5 °C to 18.3 °C. Turbidity was generally high, ranging from 8-35 NTUs. This study did not focus on the source of the turbidity at the sampling stations however it is noted that turbidity decreases substantially from the urban to rural fish sampling sites.

Table 5. Water quality results for fish sampling Sites 1(a)-13.

Station ID/Time of measurement	Water Temperature (°C)	Dissolved Oxygen (mg/l)	pH	Turbidity (NTU)	Conductivity (mS/cm)
#1(a)08:54	17.6	9.73	8.15	22	1.21
#1/09:05	17.8	8.8	8.15	16	1.09
#2/09:30	16.3	9.5	8.10	17	1.11
#3/10:00	15.9	8.4	8.87	28	1.16
#4/08:50	18.2	9.2	8.25	22	1.14
#5 Did not sample in 2008					
#6/12:30	17.6	9.08	8.78	23	1.15
#7/14:05	17.9	9.7	8.76	27	1.20
#8/9:40	17.2	9.6	8.24	17	1.28
#9/13:10	18.5	8.4	8.31	35	1.11
#10/08:55	16.5	9.2	8.80	17	1.30
#11/12:30	18.0	8.9	8.20	20	1.10
#12/08:30	15.5	9.6	8.70	8	1.16
#13/11:20	16.0	9.11	8.70	11	1.12

Section 2-Upper Coyote Creek (Sampling Sites UCC A-D)

Hydrographs

Mean daily discharge for Upper Coyote Creek Sites A, A2 and B is depicted by the Edenvale gauge data shown in Figure 6. Upper Coyote Creek Sites C and D, TCHCP Site 3 are depicted by the Madrone gauge in Figure 31. Flows in this area of the creek are influenced by releases from Anderson Reservoir as well as flow augmentation from a hydroelectric facility and San Felipe pipeline. Base flows at fish sampling sites C, TCHCP site 3 and D are significantly higher than the downstream sampling sites. The two sampling sites downstream of Ogier Ponds, TCHCP 1 and 2 have lower base flows due to groundwater percolation. Manual discharge measurements were taken at each of the sites and are shown in Table 6.

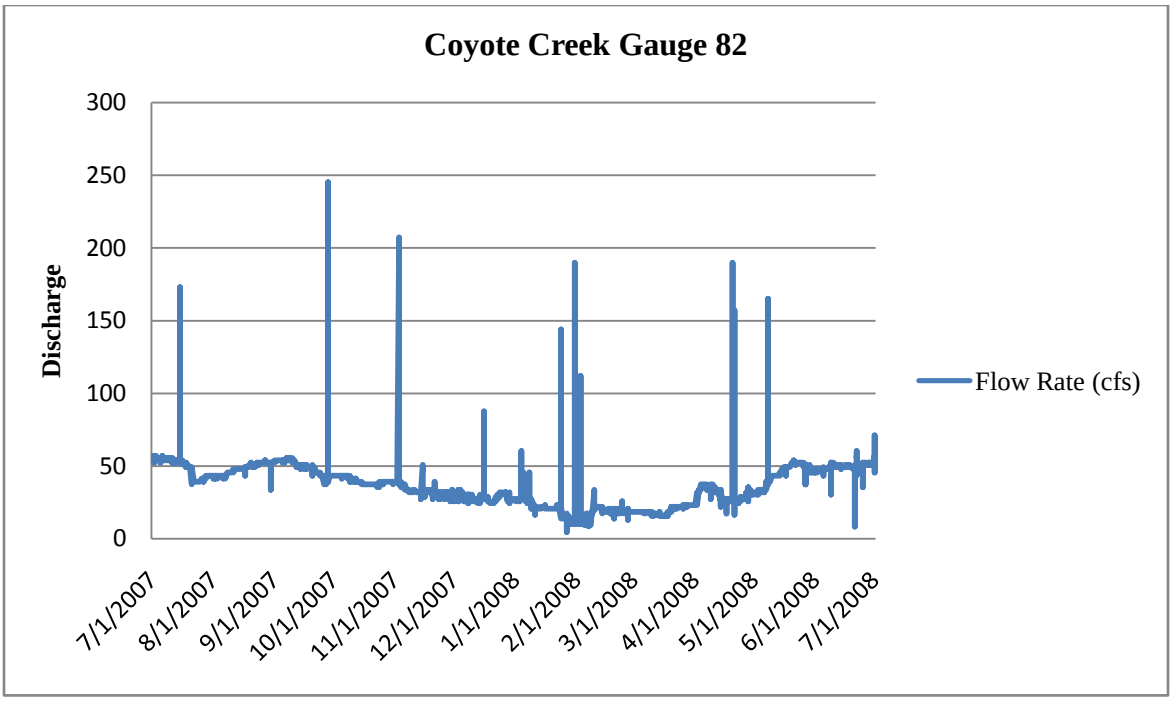


Figure 31. Mean daily discharge report for Madrone stream gauge (82) on Coyote Creek for water year 2007/08.

Table 6. Manual discharge at Upper Coyote Creek Sites.

Site ID	Date	Discharge (cfs)
Upper Coyote Creek site A	May 5, 2008	3.6
Upper Coyote Creek site A2	May 13, 2008	4.7
Upper Coyote Creek site B	May 5, 2008	4.8
TCHCP site 1	April 22, 2008	11.2
TCHCP site 2	May 6, 2008	14.8
Upper Coyote Creek site C	May 12, 2009	19.8
TCHCP site 3	May 7, 2009	38.3
Upper Coyote Creek site D	May 12, 2008	43.6

Habitat Types

A total of 1695 linear feet of Coyote Creek was sampled upstream of the flood protection project limits (Table 7). The linear feet of each type of habitat sampled from upstream of Interstate 280 to Anderson Reservoir is summarized in Figure 32.

Table 7. Habitat units sampled in 2008 at each site in Upper Coyote Creek.

Site ID	Habitat Units* (linear feet)
UCC site A	MCP (204)
UCC site A2	MCP (210)
UCC site B	MCP (88) Run (71) LSP (28) LGR (13)
TCHCP site 1	MCP (122) Run (88)
TCHCP site 2	MCP (78) LSP (22) Run (80) LGR (40)
UCC site C	MCP (33) LSP (73) LGR (85) BWP (21)
TCHCP site 3	MCP (37) LSP (110) LGR (87)
UCC site D	LSP (74) Run (69) LGR (62)

*MCP=mid-channel pool, LSP=lateral scour pool, LGR=low gradient riffle, BWP=back water pool

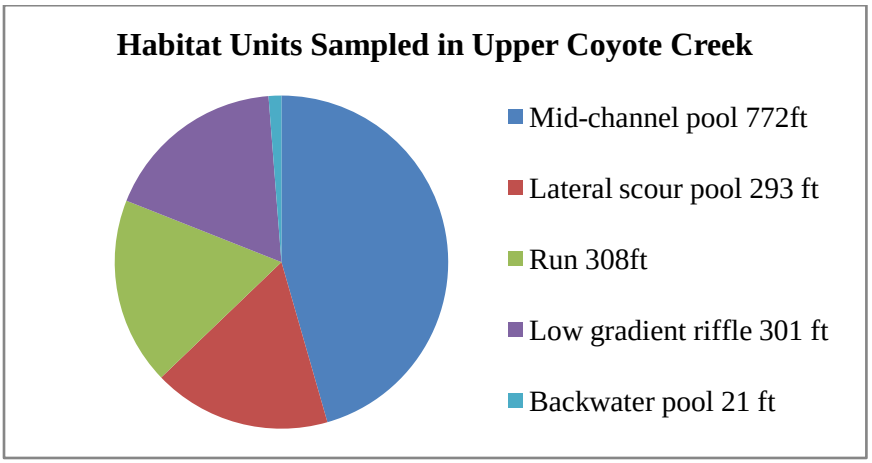


Figure 32. Total of each habitat units sampled at the eight reference reaches in Upper Coyote Creek from upstream of Interstate 280 to Anderson Reservoir during the baseline fisheries surveys in 2008.

Fish Captured

Eight species of fish, representing 6 families, were captured at eight sampling locations on Coyote Creek upstream of the flood protection project limits (Figure 33). Seven of the eight species of fish captured are native to the Coyote watershed with two of the species being found in the greatest abundance, prickly sculpin and Sacramento sucker. At five of the eight sites, fewer than fifteen fish were captured (Table 7).

Prickly sculpin was captured at six sites (UCC B,C and D, TCHCP 1, 2 and 3) in fast run and riffle habitat however, the majority of fish were captured in low gradient riffles at sites UCC C (15 fish) and TCHCP site 3 (16 fish) (Figure 34).

Sacramento sucker were captured at five sites however the majority of fish captured were at site UCC D (33 fish). Most of the suckers at this site were subadults (>100 mm fork length) and found in deeper pools with complex cover such as root wads and undercut banks (Figure 35).

Rainbow trout were captured at two sites, UCC C (12 fish) and TCHCP 3 (7 fish). All trout captured at UCC C ranged in size from 46-83 mm fork length and were captured in low gradient riffle habitat. Three adult rainbow trout, 228-250 mm fl, were captured at TCHCP site 3 at the base of a riffle in a lateral scour pool (Figure 36). The four other trout captured at this site ranged in size from 59-85 mm fl and were captured in the low gradient riffle.

Three tule perch were captured at site TCHCP site 2 in a pool with emergent aquatic plants (*Typha sp*.). Two gravid females were captured in slow moving water at the margin of a large pool. A juvenile (*Actinemys marmorata*) Western pond turtle, California State Species of Special Concern, was also observed in an off channel pool with emergent aquatic plants at this site.

Threespine sticklebacks were captured in a backwater pool with emergent aquatic plants at site UCC C with the exception of 1 which was captured in a lateral scour pool at TCHCP site 3.

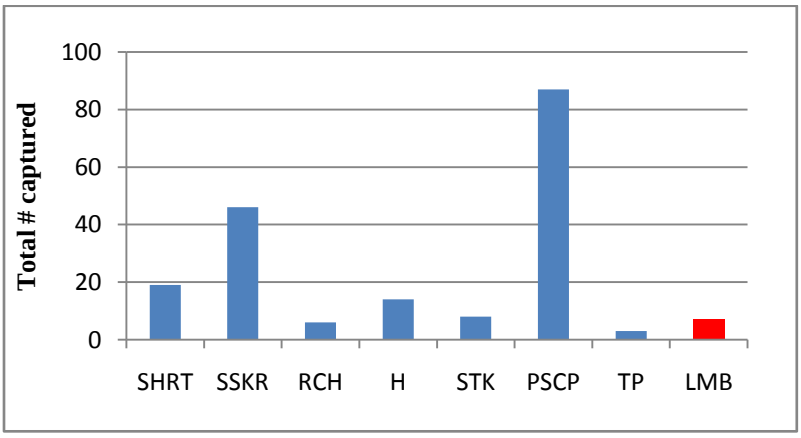


Figure 33. Total number of each species captured in the eight reference reaches on Coyote Creek above Interstate 280 to Anderson Reservoir. (Native fish are depicted in blue. Introduced fish depicted in red).

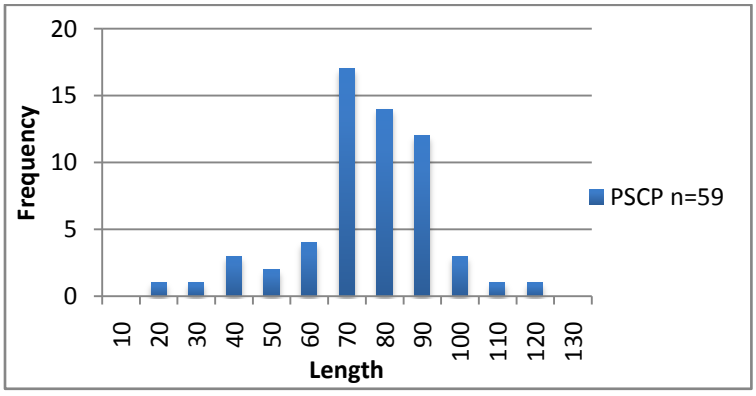


Figure 34. Length frequency histogram for prickly sculpin captured at five sampling stations in Upper Coyote Creek.

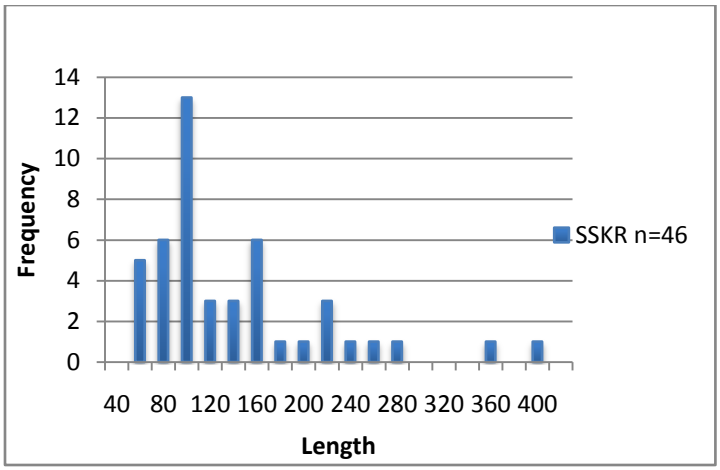


Figure 35. Length frequency histogram for Sacramento sucker captured at six sampling stations in Upper Coyote Creek.

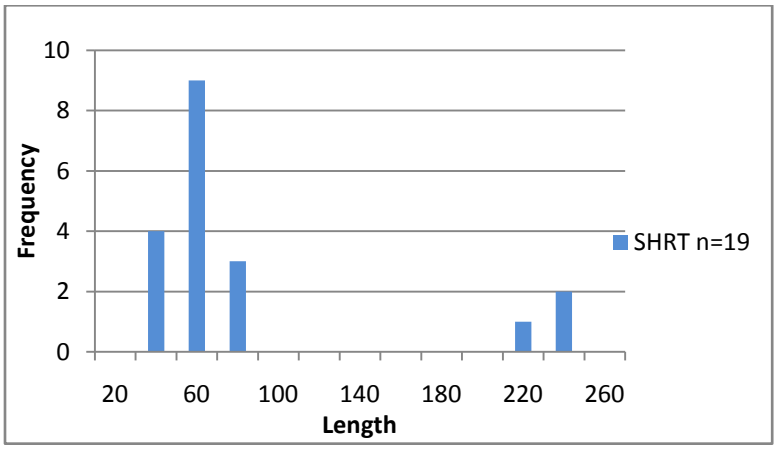
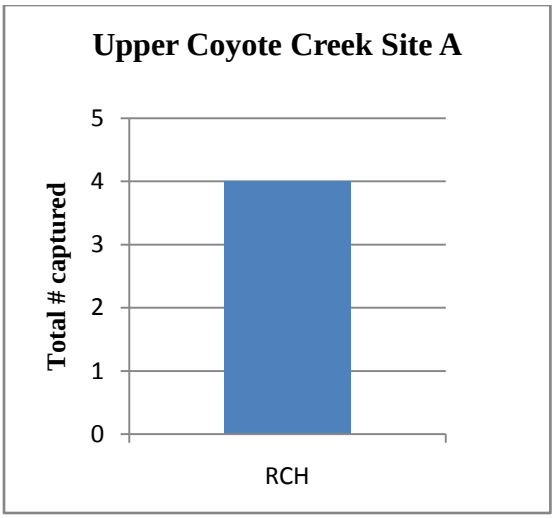


Figure 36. Length frequency histogram for rainbow trout captured at two sampling stations in Upper Coyote Creek.

Population Estimates

The greatest number of fish was captured at site UCC D (62 fish) while the fewest fish captured was at sites UCC A and UCC A1 (4 fish). No population estimates were calculated for sites UCC A, UCC A1, UCC B, TCHCP 1, TCHCP 2, and TCHCP 3 because of the low number of captures and poor depletion rates for fish. The results for these sites include total catch only. Native fish are depicted in blue on all graphs; introduced fish are depicted in red. Standard error bars are denoted on population estimate graphs along with upper and lower confidence intervals.



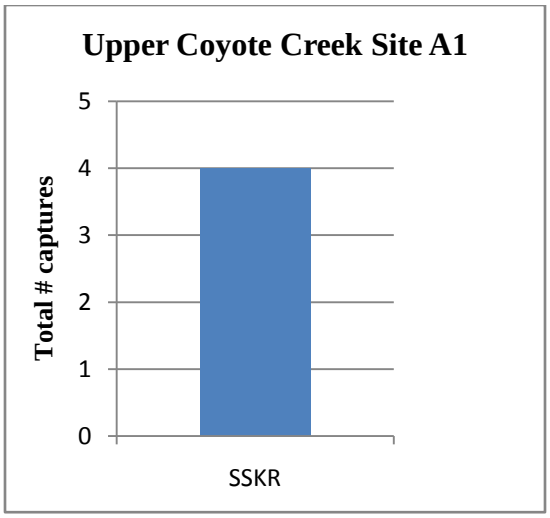


Figure 37. Total catch reported for UCC Site A. Figure 38. Total catch reported for UCC Site A1.

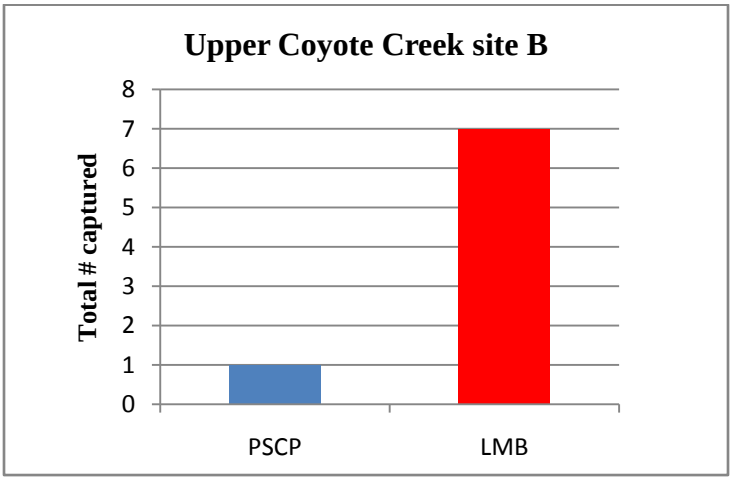
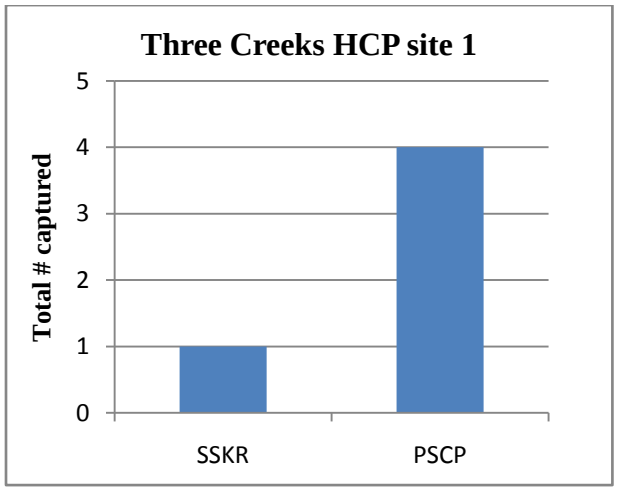


Figure 39. Total catch reported for UCC Site B.



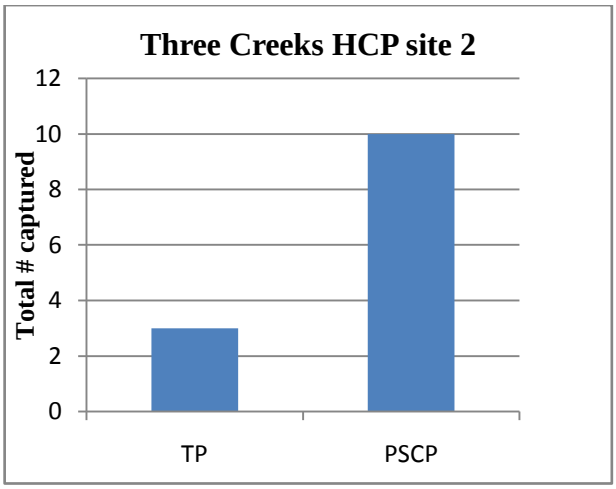


Figure 40. Total catch reported for TCHCP Site 1**. Figure 41.** Total catch reported for TCHCP Site 2.

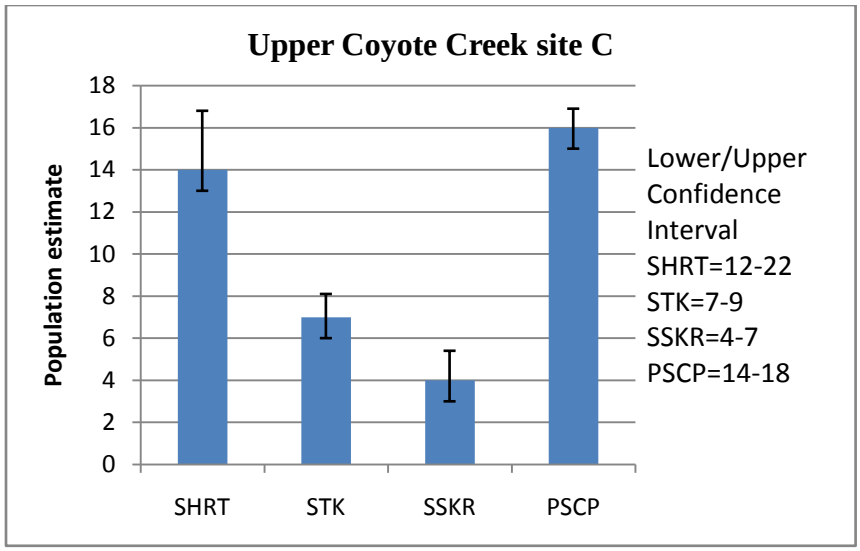


Figure 42. Populations estimates for species captured at sampling Site UCC C.

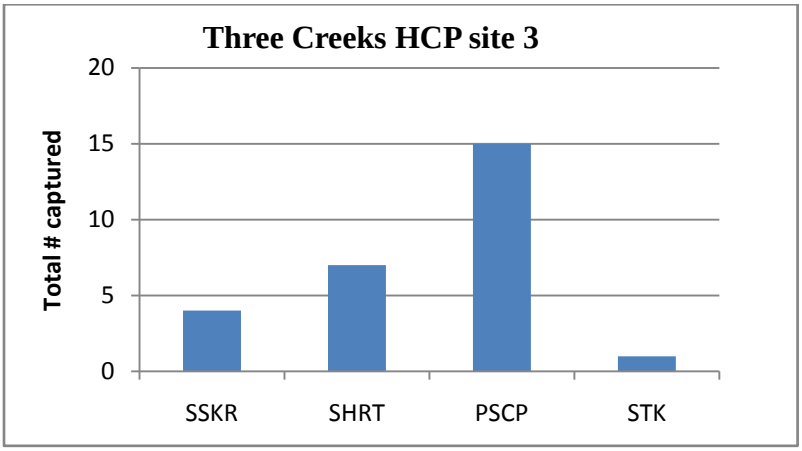


Figure 43. Total catch reported for sampling Site TCHCP 3.

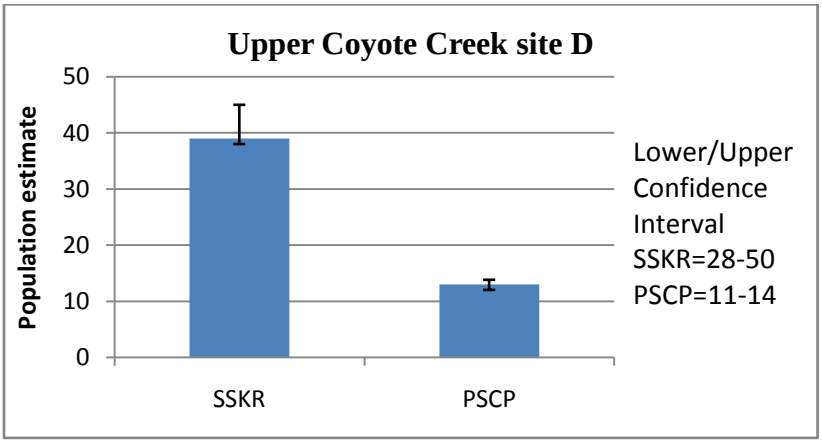


Figure 44. Population estimates Sacramento sucker and prickly sculpin for UCC Site D.

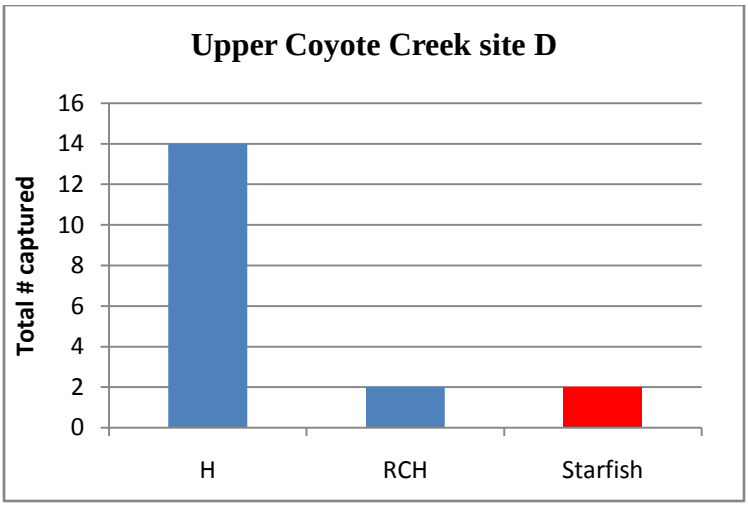


Figure 45. Total catch reported for the remaining species with poor depletion rates at UCC site D.

Photograph G. Two live starfish (*Pisaster sp.*) were captured adjacent to the county parks footbridge during sampling at site UCC D.

Water Quality Sampling

Water quality parameters were recorded at each sampling site prior to electrofishing activities (Table 8). All sites had sufficient dissolved oxygen levels to support aquatic life. Water temperatures ranged within the eight reference stations from 13.5 °C to 17.0 °C. Turbidity and conductivity was significantly lower at rural sites then at all other sampling sites on the mainstem of Coyote Creek.

Table 8. Water quality results for fish sampling Sites Upper Coyote Creek A-D.

Station ID/Time of measurement	Water Temperature (°C)	Dissolved Oxygen (mg/l)	pH	Turbidity (NTU)	Conductivity (mS/cm)
Upper Coyote Creek site A/10:00	15.0	9.01	8.7	15	1.15
Upper Coyote Creek site A1/08:10	16.0	9.67	7.8	12	0.790
Upper Coyote Creek site B/12:05	16.8	9.51	8.8	4	0.581
Three Creeks HCP site 1/12:40	15.8	10.7	8.5	3	0.471
Three Creeks HCP site 2/08:35	17.0	10.5	8.8	6	0.479
Upper Coyote Creek Site C/08:20	13.5	10.7	7.8	5	0.533
Three Creeks HCP site 3/08:30	13.5	10.61	8.9	4	0.496
Upper Coyote Creek Site D/12:20	13.7	9.56	7.6	4	0.521

Section 3-Upper Penitencia Creek Sites A and B and Lower Silver Creek Site A

A total of 829 linear feet of stream was sampled in Upper Penitencia Creek in 2008 (Figure 46). Upper Penitencia Creek site A was 625 linear feet in length and was comprised of lateral scour pool (192 ft.), mid-channel pool (60 ft), run (245 ft.) and low gradient riffle (128 ft.). Upper Penitencia Creek Site B was comprised of mid-channel pools (Noble fish ladder plus pool adjacent) (80 ft.), lateral scour pool (50 ft.), run (52 ft.) and low gradient riffle (22 ft.).

Two hundred linear feet of stream were sampled at Lower Silver Creek site A in 2008. The habitat units consisted of 190 feet of mid-channel pool and 10 feet of backwater pool.

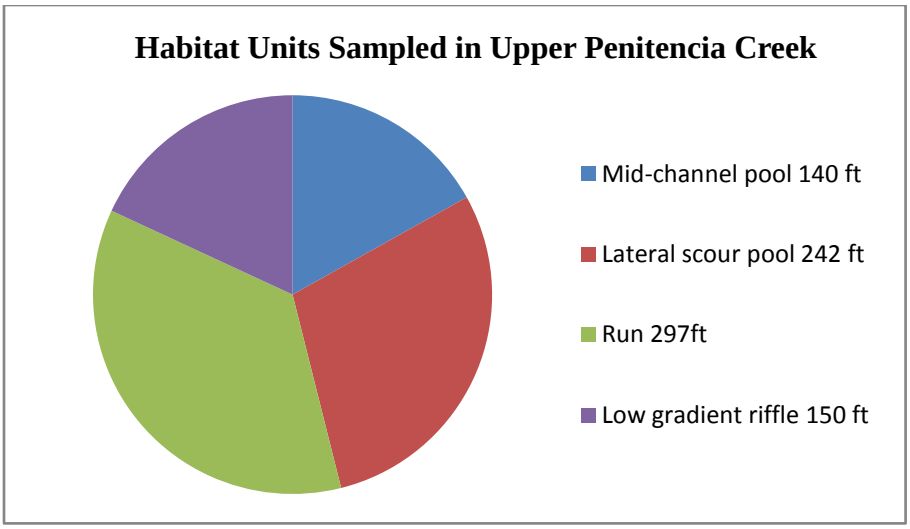


Figure 46. Total linear feet of each habitat type sampled in 2008 for the two reference reaches in Upper Penitencia Creek.

Fish Captured

Eight species of fish representing five families were captured in Upper Penitencia Creek in 2008. All but three species of fish captured, eleven individuals, was native to the watershed (Figure 47). All of the introduced fish were captured at Site A. Sacramento sucker and prickly sculpin were the two most abundant species captured and with the exception of one Sacrament sucker, all of these fish were captured at Site A. All Pacific lamprey (33) were ammocetes and were captured at sampling site A (Figure 49). Twenty-seven rainbow trout were captured at sampling Site B ranging in size from 34-178 mm fork length while 10 trout (55-86 mm fl) were captured at sampling Site A (Figure 48). All of the trout captured at sampling Site B were found in the fish ladder pools and the larger pool adjacent to the ladder. Two of the larger trout at sampling Site B showed evidence of smolting while the remainder of the larger trout had visible parr marks. Most of the trout captured at sampling Site B had blackspot, a digenetic fluke parasite (Photograph H). It should be noted on the day of sampling that Site B was isolated by low flows above and below the Noble Avenue fish ladder even though discharge at the ladder was measured at 1.01 cfs (Photographs I and J). The ladder was completely dry by June 1, 2008.

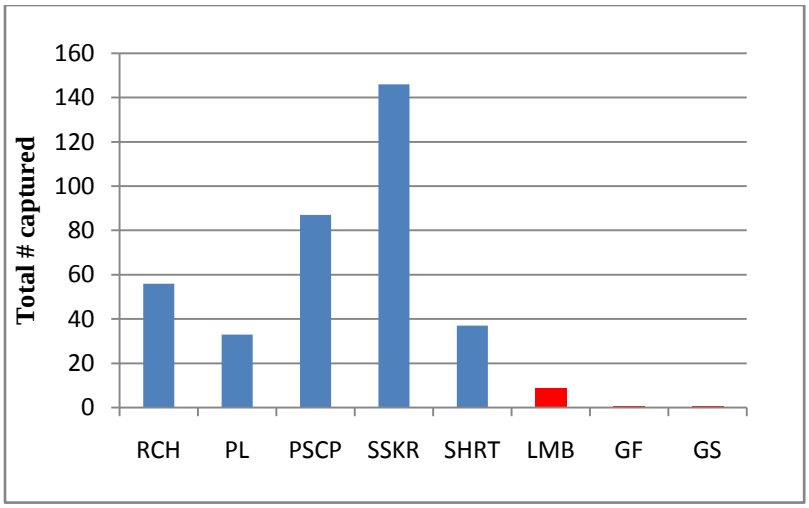
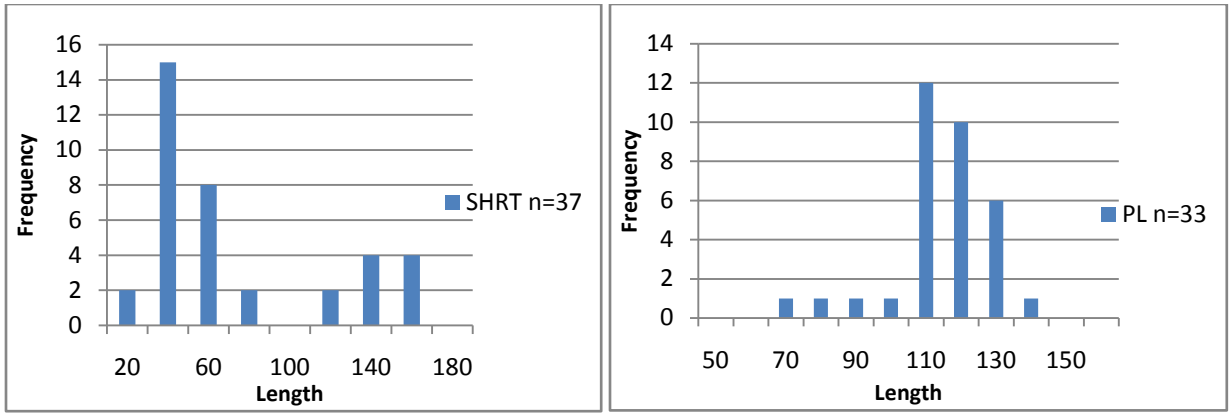


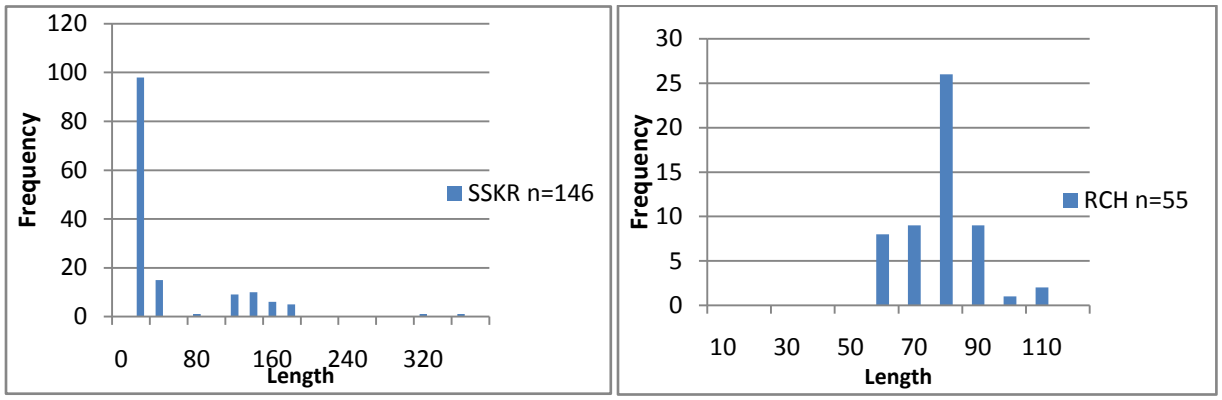
Figure 47. Total number of each species of fish captured at two reference reaches on Upper Penitencia Creek. (Native fish are depicted in blue. Introduced fish depicted in red).

Photograph H. Rainbow trout captured at Upper Penitencia Creek Site B with blackspot parasite.

Photograph I. Upper Penitencia Creek downstream of Noble Fish ladder May 15, 2008.
Photograph J. Upper Penitencia Creek upstream of Noble Fish ladder May 15, 2008.



Figures 48 and 49. Length frequency histogram for rainbow trout and Pacific lamprey captured in Upper Penitencia Creek.



Figures 50 and 51. Length frequency histogram for Sacramento sucker and California roach captured in Upper Penitencia Creek.

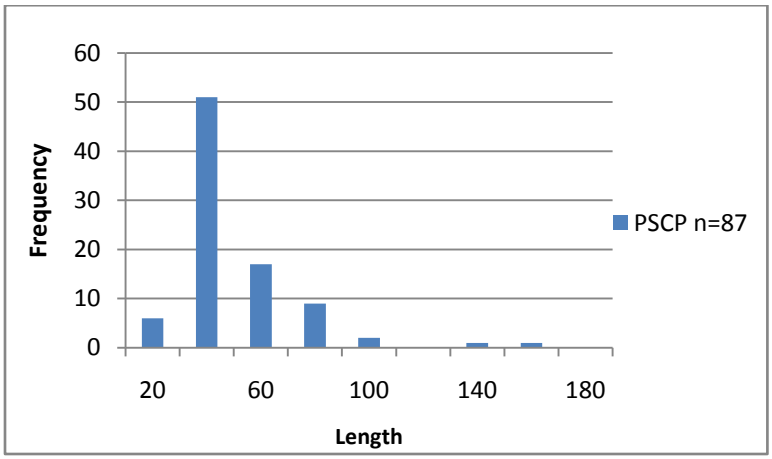


Figure 52. Length frequency histogram for prickly sculpin captured in Upper Penitencia Creek**.**

Population Estimates for Upper Penitencia Creek

Population estimates were calculated for captured fish at both sampling sites in Upper Penetencia Creek if the fish were caught on more than one pass and depletion numbers were adequate. There was no population estimates calculated for Pacific lamprey, largemouth bass, golden shiner and goldfish due to low capture rates or poor depletion on subsequent passes. Standard error bars are denoted on population estimate graphs along with upper and lower confidence intervals for each species.

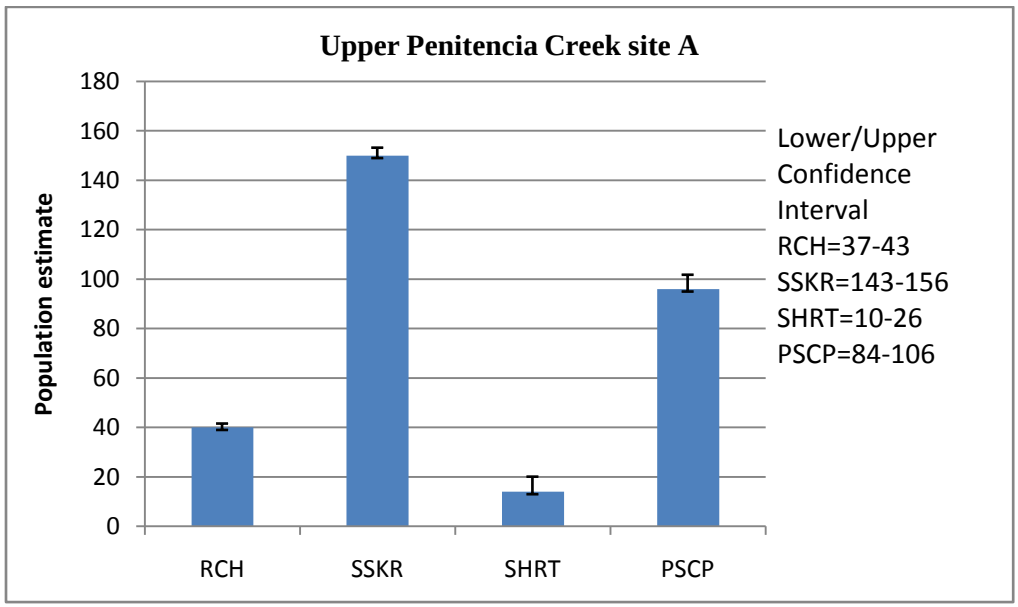


Figure 53. Population estimates for fish captured in Upper Penitencia Creek site A in 2008.

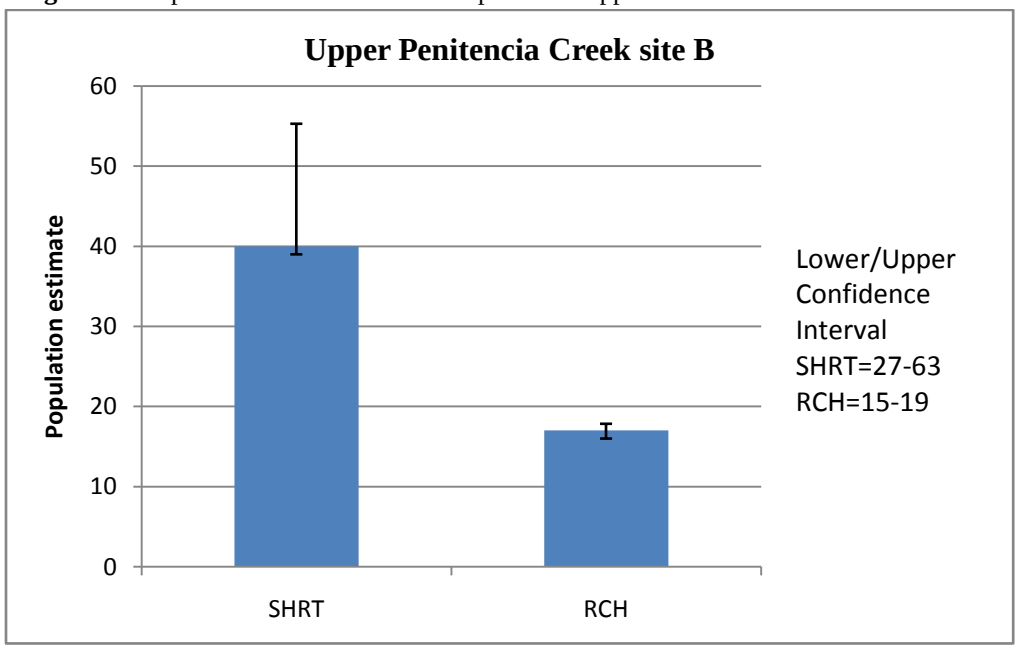


Figure 54. Population estimates for fish captured at Upper Penitencia Creek site B in 2008**.**

Population Estimates for Lower Silver Creek

Sacramento sucker and California roach were the most abundant species captured and most specimens captured of both species were fry ranging in size from 5-10 mm total length. Red shiner and mosquitofish were the only other species captured at this site. Mosquitofish had poor depletion rates and were not included in the population estimate. Standard error bars are denoted on the population estimate graph along with upper and lower confidence intervals for each species.

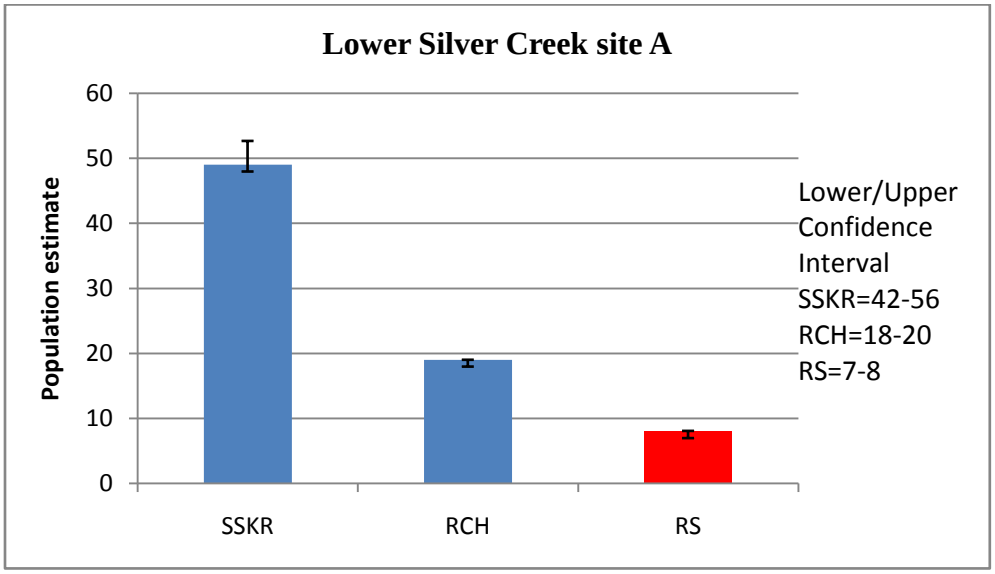


Figure 55. Population estimates for Sacramento sucker, California roach and red shiner captured in Lower Silver Creek site A.

Water Quality Sampling

Water quality measurements were recorded at each sampling site prior to electrofishing activities (Table 9). All sites had sufficient dissolved oxygen to support aquatic life. Water temperatures ranged within the tributary reference stations from 14.8 °C to 19.9 °C. Although sampling at Upper Penitencia Creek site B was conducted on May 15, 2008 water temperatures were most likely elevated due to the discontinuous flow.

Table 9. Water quality monitoring results for Upper Penitencia Creek, Sites A and B, and Lower Silver Creek Site A.

Station ID/Time of measurement	Water Temperature (°C)	Dissolved Oxygen (mg/l)	pH	Turbidity (NTU)	Conductivity (mS/cm)	Discharge (cfs)
Upper Penitencia Creek Site A/09:00	16.7	10.30	7.05	7	0.498	3.1
Upper Penitencia Creek Site B/09:00	19.9	9.94	8.04	1	1.57	1.0
Lower Silver Creek Site A/08:30	14.8	9.69	8.82	8	1.54	6.8

Results of Fish Passage Analysis-Singleton Road Crossing

Measurements taken at the Singleton Road culverts were analyzed using the FishXing software for both *O. mykiss* and *E. tridentatus*. Tables 10 through 14 summarize the biological criteria and fish passage results for adult and juvenile *O. mkiss* and adult *E. tridentatus*.

In summary, both culverts did not meet fish passage criteria for adult *O. mykiss* at any range of flow. Both culverts presented a depth, velocity, outlet drop barrier as well as a pool depth barrier for the flows presented in this analysis. Since the physical parameters of the pipes are different (i.e. slope), the barrier type varied under the different flow scenarios for each culvert.

Table 10. The physical parameters of the two culvert pipes located under Singleton Road crossing on the mainstem of Coyote Creek.

	Culvert Crossing Number 1	Culvert Crossing Number 2
Culvert Type	3.2 ft Circular	4.0 ft Circular
Construction	Annular 2.67x1/2 inch	Annular 2.67x1/2 inch
Installation	Not Embedded	Not Embedded
Culvert Roughness Coefficient	0.024	0.024
Culvert Length	61.3 ft	59.9 ft
Culvert Slope	1.62%	0.82%
Inlet Invert Elevation	97.79 ft	97.21 ft
Outlet Invert Elevation	96.8 ft	96.72 ft

Table 11. Biological criteria for adult and juvenile rainbow trout used in the fish passage evaluation of the two culvert pipes.

	Biological Criteria For Adult Rainbow trout	Biological Criteria For Juvenile Rainbow trout
Fish Length	50 cm	20 cm
Minimum water depth	0.8 ft	0.5 ft
Prolonged Swim Speed	6 ft/s	4 ft/s
Prolonged Time to Exhaustion	30 min.	30 min.
Burst Swim Speed	10 ft/s	5 ft/s
Burst Time to Exhaustion	5 s	5 s

For the purposes of this evaluation, the juvenile trout was presumed to be out-migrant fish and would be swimming downstream through the pipes. Therefore, a velocity barrier may not inhibit fish from going downstream through the culverts. The FishXing® software was however used to analyze the range of flows in which the culverts present a depth barrier for out-migrant trout. The results of that analysis are 3.0-30.6 cfs and 3.0-13.9 for culverts one and two respectively. A velocity and pool depth barrier would be present at all flows for juvenile rainbow trout making localized movements upstream through the culvert pipes.

Table 12. Fish passage evaluation summary results for adult rainbow trout. (Results are based on the physical parameters of the pipe, biological criteria and a flow range from 3-500 cfs)

	Fish Passage Summary for Culvert 1-Adult Rainbow trout	Fish Passage Summary for Culvert 2-Adult Rainbow trout
Low Passage Design Flow	3.0 cfs	3.0 cfs
High Passage Design Flow	500.0 cfs	500.0 cfs
Percent of flows Passable	0.0%	0.0%
Passable Flow Range	None	None
Depth Barrier	3.0 to 31.3 cfs	3.0 to 14.8 cfs
Outlet Drop Barrier	3.0 to 206.5 cfs	3.0 to 252.6 cfs
Velocity Barrier	59.1 to 500.0 cfs	49.1 to 500.0 cfs
Pool Depth Barrier	3.0 to 27.6 cfs	3.0 to 31.9 cfs

Table 13. Biological criteria used for adult Pacific lamprey to evaluate upstream fish passage in the two culvert pipes.

Biological Criteria For Adult Pacific lamprey	
Fish Length	45 cm
Minimum water depth	0.3 ft
Prolonged Swim Speed	1.48 ft/s
Prolonged Time to Exhaustion	30 min.
Burst Swim Speed	4.59 ft/s
Burst Time to Exhaustion	5 s

The result of the passage assessment for adult lamprey was that both culverts did not meet fish passage criteria for the range of flow selected. In general, the swimming performance for *E. tridentatus* is inefficient compared to that of *O. mykiss* (Mesa et al., 2003). The program did not take into account the role of attachment when the fish is confronted with rapid current velocities. However, attachment to the surface of the culverts bottom is unlikely since the culverts are perched off the water surface and corrugated. While it is known that lamprey ammocetes make downstream movements during their fresh water residency period, the extent of upstream movement for juveniles is unknown (Moyle, 2002). No analysis was performed for juvenile movement upstream however it should be noted that the culverts likely present a complete passage barrier for juvenile lamprey.

Table 14. Fish passage evaluation summary results for adult Pacific lamprey. (Results are based on the physical parameters of the pipe, biological criteria and a flow range from 3-500 cfs)

	Fish Passage Summary for Culvert 1-Adult Pacific lamprey	Fish Passage Summary for Culvert 2-Adult Pacific lamprey
Low Passage Design Flow	3.0 cfs	3.0 cfs
High Passage Design Flow	500.0 cfs	500.0 cfs
Percent of flows Passable	0.0%	0.0%
Passable Flow Range	None	None
Depth Barrier*	3.0 to 31.3 cfs	3.0 to 14.77 cfs
Outlet Drop Barrier	3.0 to 206.5 cfs	3.0 to 252.57 cfs
Velocity Barrier*	3.73 to 500.0 cfs	3.0 to 500.0 cfs

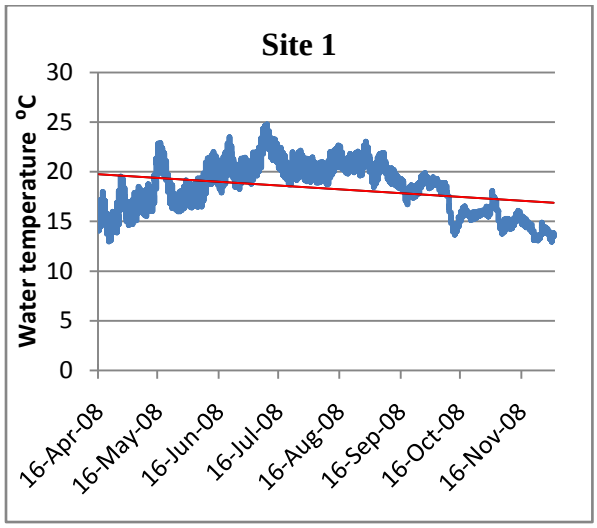
*The depth and velocity barrier parameters do not take into consideration the role of the suctorial disc in passage for adult lamprey therefore the results may be overestimated.

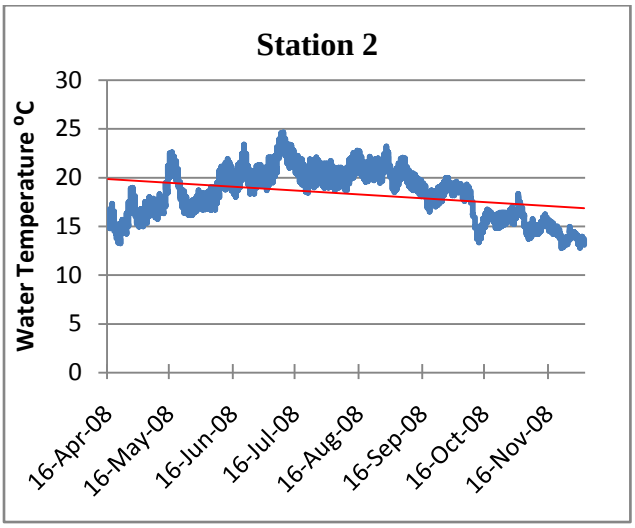
Temperature Results

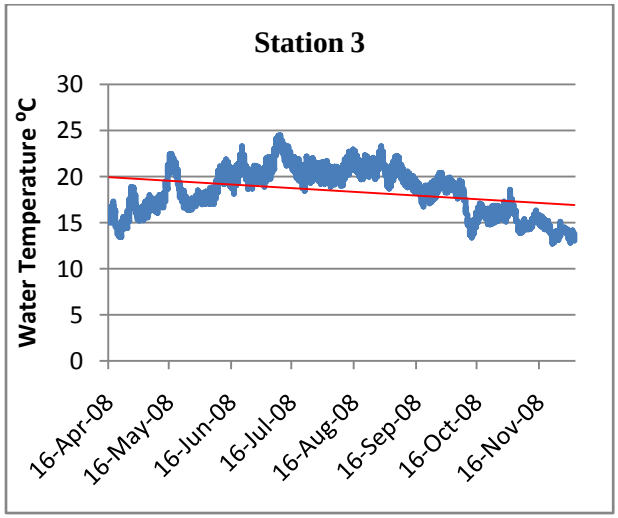
Table 15. Temperature logger locations, deployment and retrieval dates for 2008.

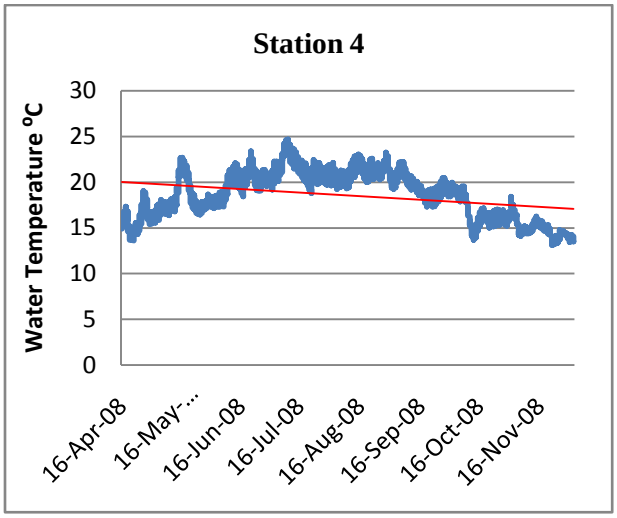
Temperature Logger Station ID	Location	Date water monitors were deployed	Date water loggers were retrieved
1	Downstream Montague Expressway	4/16/2008	12/3/2008
2	Downstream Charcot Avenue	4/16/2008	12/3/2008
3	Downstream O' Toole	4/16/2008	12/3/2008
4	Upstream Ridder Park Drive	4/16/2008	12/3/2008
5	Upstream Old Oakland Road	4/16/2008	12/4/2008
6	Downstream Berryessa Road	4/16/2008	12/4/2008
7	Upstream Berryessa Road	4/16/2008	12/4/2008
8	Upstream Mabury Road	4/16/2008	12/4/2008
9	Downstream East Julian Street	4/16/2008	12/4/2008
10	Downstream East Santa Clara Street	4/21/2008	12/3/2008
11	Downstream East San Antonio Street	4/16/2008	12/4/2008
12	Upstream East William Street	4/21/2008	12/4/2008
13	Upstream Interstate 280	4/16/2008	12/3/2008
14	Lower Silver Creek upstream of confluence with Coyote Creek	4/16/2008	12/4/2008

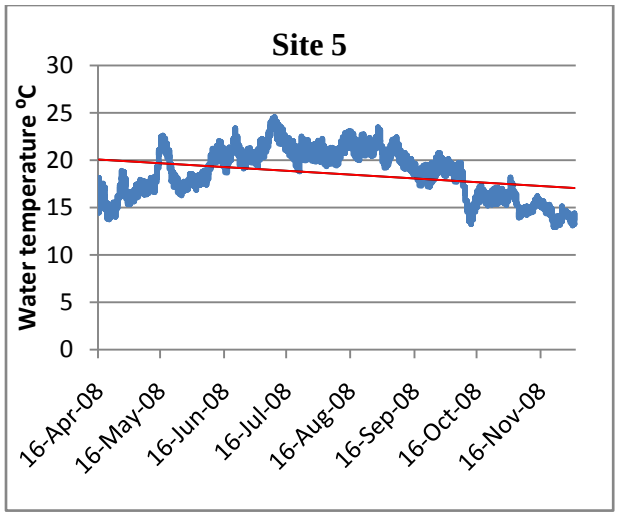
Figures 56-68 represents the results of the temperature monitoring stations (1-14) for sampling year 2008**.** The red line depicts a linear (least squares fit) trend line for the temperature data.

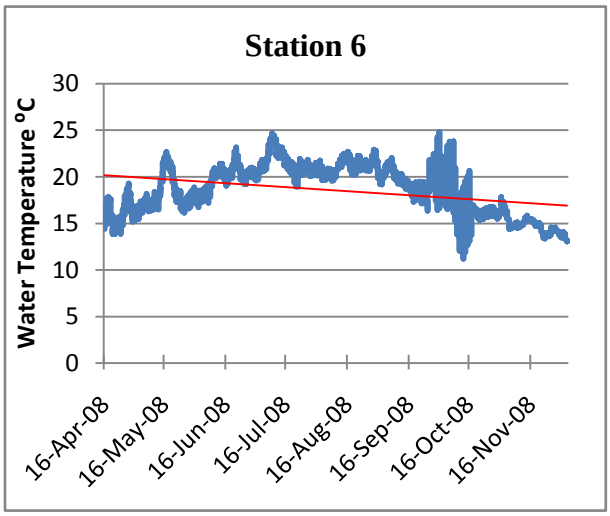




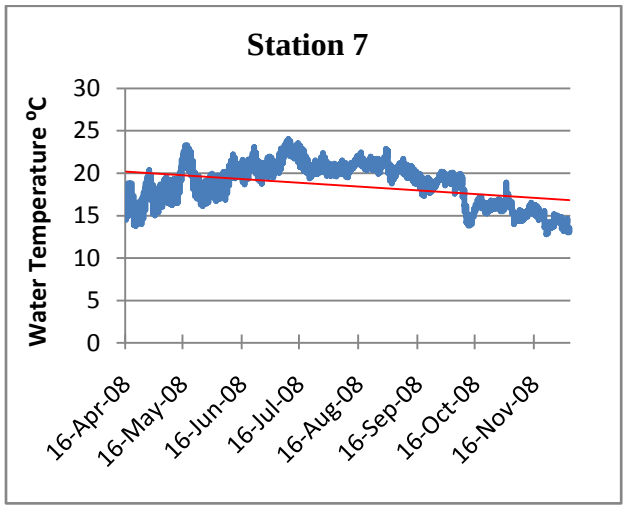


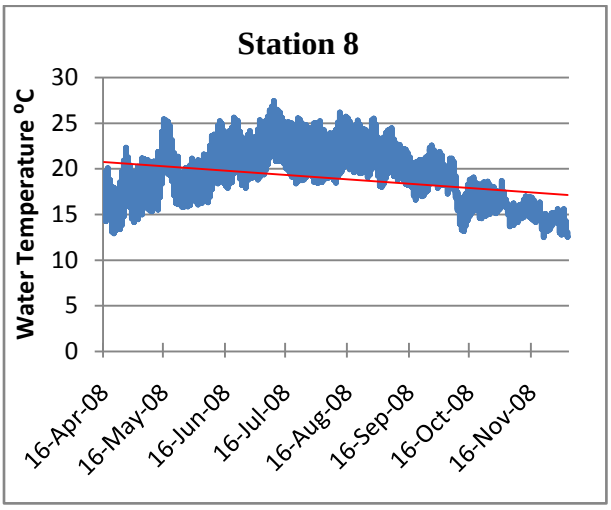


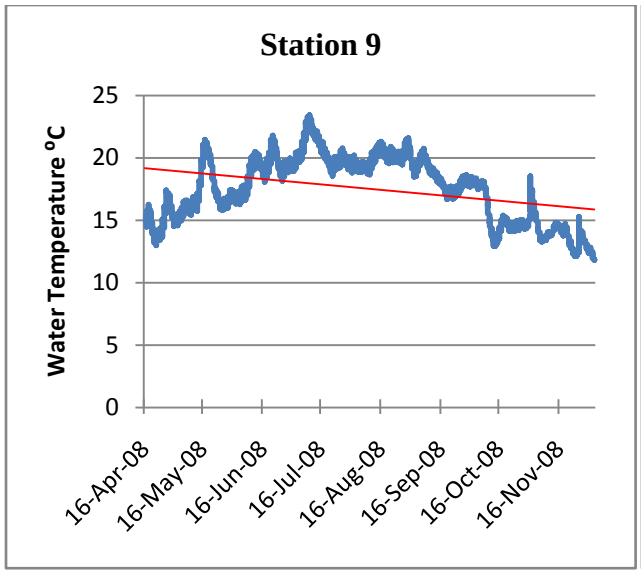


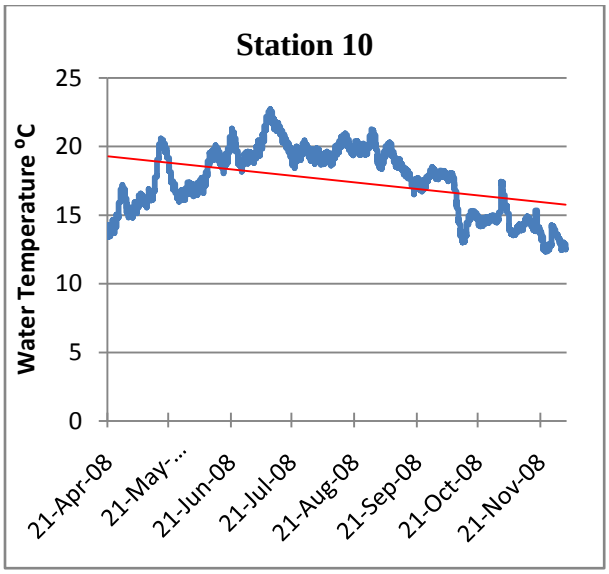


*Station 6 water diverted upstream of temperature logger for bank repair from Sept. 18-October 20 2008.

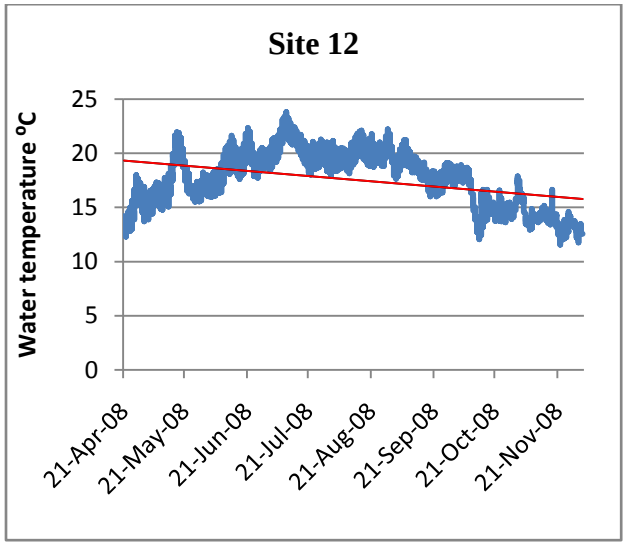





Station 9
Water Temperature °C
25
20
15
10
5
0
16-Apr-08
16-May-08
16-Jun-08
16-Jul-08
16-Aug-08
16-Sep-08
16-Oct-08
16-Nov-08


Station 10
Water Temperature °C
25
20
15
10
5
0
21-Apr-08
21-May-...
21-Jun-08
21-Jul-08
21-Aug-08
21-Sep-08
21-Oct-08
21-Nov-08

Site 11
Water temperature °C
30
25
20
15
10
5
0
16-Apr-08
16-May-08
16-Jun-08
16-Jul-08
16-Aug-08
16-Sep-08
16-Oct-08
16-Nov-08


Site 12
Water temperature °C
25
20
15
10
5
0
21-Apr-08
21-May-08
21-Jun-08
21-Jul-08
21-Aug-08
21-Sep-08
21-Oct-08
21-Nov-08

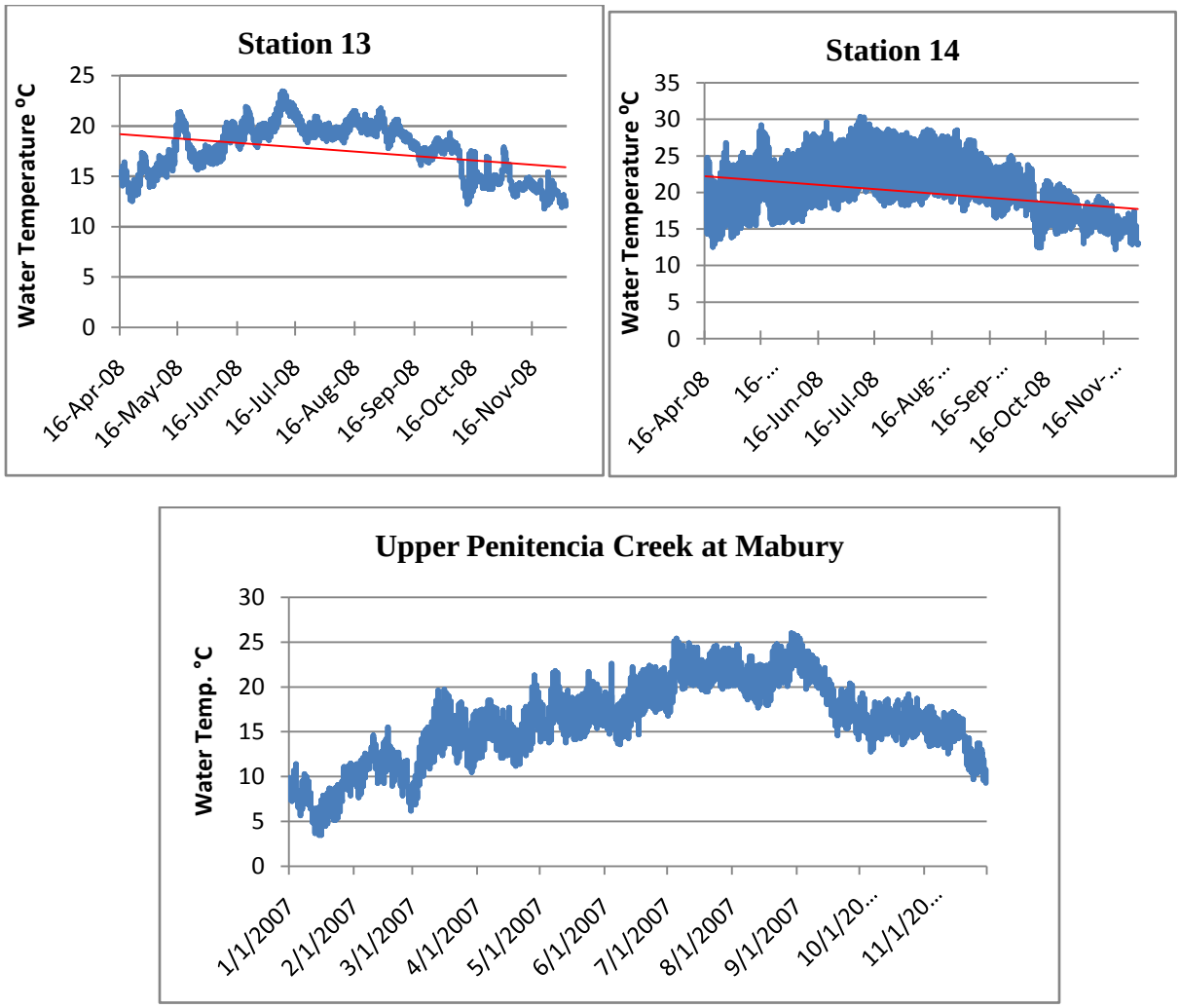


Figure 69. Results of temperature monitoring sensor for 2007 located at Mabury fish ladder**.**

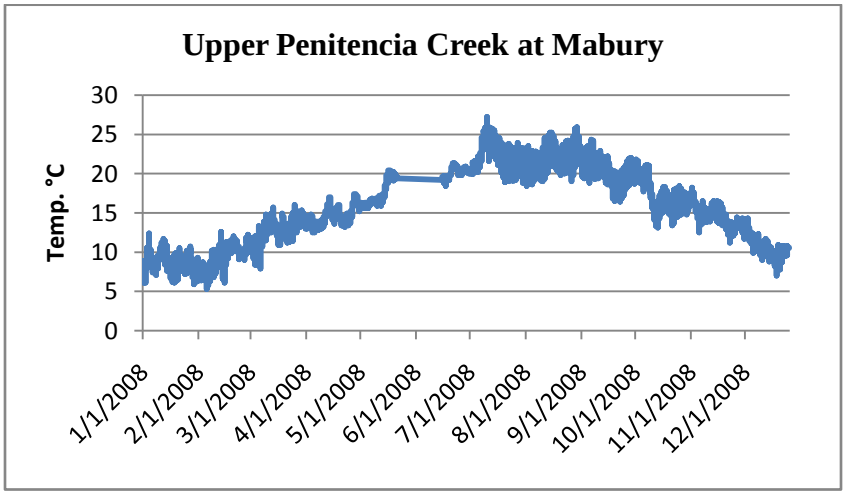


Figure 70. Results of temperature monitoring sensor for 2008 located at Mabury fish ladder. The sensor was inoperable from 5/15/2008 to 6/16/2008.

Discussion

A total of 5437 linear feet of stream at 24 locations within the Coyote Creek watershed was sampled in 2008 for year two of the Mid-Coyote Creek Baseline Fisheries Study. These sites will be sampled in year three of the study. Once data collection is complete, a full analysis of habitat variables coupled with population estimates will be presented for the three year final comprehensive report. This analysis will help determine which variables favor native fish in Coyote Creek. With two years of the baseline fisheries study complete, the District has obtained valuable information on the distribution and population structure of native fish within the Coyote Creek watershed. It is premature to draw detailed conclusions from two years of sampling data however, the previously established goals and objectives are on target to be met by the conclusion of the sampling effort in year three (2009).

For year two of the fisheries monitoring, total catch was relatively low at all sites sampled both in the project reach, tributaries and upper portion of Coyote Creek above Interstate 280 compared to 2007. In 2008, 362 fish were captured at 13 sampling sites in the project reach compared to 2007 in which 1048 fish were captured. Only 3 lampreys were captured in the project reach in 2008 compared to 63 captured in 2007. Thirteen trout however, were captured at two sites downstream of Upper Penitencia Creek in 2008 (sampling sites 6 and 7) while no trout were captured in the flood control project reaches in 2007. Water operations and natural dryback zones in Upper Penitencia Creek may have affected the distribution of trout on the mainstem of the creek in 2008. The origin of the trout captured in these reaches is unknown however; it is presumed that the fish originated from Upper Penitencia Creek since habitat conditions within this tributary are more conducive to successful spawning and rearing of steelhead trout then the mainstem of Coyote Creek (Stillwater Sciences, 2006). Nine of the thirteen trout were fry, 29-36 mm fork length, while the two largest fish, 146 and 189 mm fork length, showed evidence of smoltification.

Dryback zones in Upper Penitenica Creek are a natural occurrence due to high percolation of water through the porous alluvial gravels. After two years of sampling in arid conditions, it appears as though water operations and dry back zones in Upper Penitencia Creek affect steelhead and lamprey utilization of the Mid-Coyote flood control reaches and may cause stranding of steelhead adult and smolts in Upper Penitencia Creek. The SCVURPPP identified this lower dryback zone on Upper Penitencia Creek as having the potential to create passage problems for outmigrant steelhead smolts in the Assessment of Stream Ecosystem Functions for Coyote Watershed (SCVURPPP, 2003). During sampling for this study in 2007 and 2008 in Upper Penitencia Creek, sampling Site B was isolated and water temperature elevated due to the low stream flows. There is a high probability that the steelhead trout captured at this site in both years eventually perished due to these isolated, warm stream conditions. It is also likely that continued drying of the stream in subsequent years will cause more fish to perish in this reach.

Sampling Site A is within the imported water zone and had the highest density of lampreys in 2008 compared to all other sampling sites in the watershed. Ten trout was also captured at sampling Site A.

Water temperatures were reported from the stream gauge temperature sensor at Mabury fish ladder for 2007 and 2008 in Upper Penitencia Creek. The results revealed that temperatures can

reach the lethal limits (>24°C) for trout within the percolation zone for short periods of time (Moyle, 2002). While the importance of temperature cannot be denied for distribution of fish species, the creek should be evaluated for all ecological benefits in which the imported water provides during different seasons. Timed releases from Cherry Flat Reservoir could possibly ameliorate the temperature conditions for trout in the imported water zone.

Historically, anadromous fish in Coyote watershed had access to many miles of suitable spawning and rearing habitat (SFEI, 2006). Alterations to the natural hydrologic regime as well as the presence of impassable reservoirs has eliminated access to miles of suitable spawning/rearing habitat and contributed to degradation of existing habitats on the valley floor. Considering the current level of urbanization in Santa Clara County, returning the creek back to its natural state is not a feasible alternative. Therefore, it is imperative to apply prudent management principles to maximize the higher quality habitats of Upper Penitencia Creek for steelhead trout, Pacific lamprey and other native fish.

The objectives of this study did not include investigations for optimal flow regimes for native fish in Upper Penitencia Creek. Information gathered during this investigation does suggest more data is required to determine how best to maximize the habitat for native fish in Upper Penitencia Creek. Natural dryback conditions limit the potential for outmigrants and adults to find refugia when discontinuous flow occurs due to limited runoff and the high rate of percolation. Consideration should be given to the reoperation of Cherry Flat reservoir to provide benefits for upmigrant/outmigrant fish by providing continuous flow during critical migration seasons. It is suggested that an ecologically based stream flow regulation plan be developed for Upper Penitiencia Creek. In addition, introduction of non natives through imported water needs to be addressed.

Four new sites were added upstream of the project reach in 2008 (UCC A1 and TCHCP sites 1, 2, 3) therefore, there is no comparable data for 2007. The upstream sites that were sampled in both 2007 and 2008, UCC A, B, C and D, had 50% fewer fish captured overall in 2008. No lamprey was found at any site on the mainstem upstream of the project reach in either 2007 or 2008. Conservation plans for this species in Coyote Creek should include areas of the watershed that they currently occupy. Nineteen trout were captured at two sites in upper Coyote Creek, UCC site C and TCHCP Site 3 in 2008. Both of these sites are located upstream of Santa Clara County Parks Ogier Pond complex (Figure 1). The three largest trout captured were at sampling Site 3, 228-250 mm fl, and they did not show any obvious signs of the parr-smolt transformation. Multiple year classes of rainbow trout were observed in Upper Coyote Creek below Anderson Reservoir in 2008 indicating successful reproduction and rearing of trout in the cold water management zone.

The results of a population genetics study for steelhead trout in Santa Clara County, sponsored by the District in 2006, included samples obtained during outmigrant trapping operations in lower Coyote Creek downstream of Montague Expressway. The results of that analysis revealed that fish in the Santa Clara Valley Region are most closely related to coastal steelhead trout populations. It was also noted, that 6 percent of the steelhead trout samples obtained from the outmigrant trapping operations were assigned directly to Upper Penitencia Creek steelhead collections. This provided evidence that there is successful outmigration of Upper Penitencia

Creek steelhead and that there may be another source for steelhead in the watershed such as the upper reaches of Coyote Creek (Garza et al., 2008). However, the information gathered from this baseline fisheries study will not be able to distinguish between resident and anadromous forms of rainbow trout in upper Coyote Creek unless obvious morphological evidence of smolting is prevalent when fish are captured. Trapping of outmigrant smolts at the base of the Metcalf facility would determine if smolt production occurs in the upper portion of the creek and if the fish can negotiate the instream ponds.

Flow regimes strongly influence the movement of salmonids and the dynamics of stream behavior (Quinn, 2005). The flow regime in upper Coyote Creek is affected by the discharge from Anderson Reservoir. The objectives of this study did not include investigation of optimal flow patterns for native fish utilizing this portion of Coyote Creek. Similar to conditions in Upper Penitencia Creek, an ecologically based stream flow regulation plan needs to be developed for native fish. Illegal introduction of starfish, a marine species, at Santa Clara County Park site (UCC site D) is an example of why sensitive species are at risk in areas where public access is high.

The fish passage impediment chosen for year two of the baseline fisheries study was the culvert crossing under Singleton Road in San Jose. The results of the analysis rated this road crossing as a total barrier for migrating steelhead trout and Pacific lamprey. While the pipes did not meet published fish passage criteria for either species, if instream flows exceed the bankfull capacity of the creek and flow goes over the road, passage may be afforded to migrating fish (Photograph F). Lampreys use their suctorial disc in areas of high velocity to surge ahead for forward movement (Moser et al. 2002.) The lack of attachment sites on the projecting culverts at Singleton Road may preclude Pacific lamprey from the watershed above this point. When analyzing passage impediments for possible remediation, the quality and quantity of upstream habitats should be evaluated (CDFG, 2003). Ranking of this site for passage remediation should be high considering approximately eighteen miles of the Coyote Creek mainstem lie above this point.

The third and final year of fisheries monitoring for this baseline study will continue in spring of 2009. A comprehensive report will be available incorporating all water quality, physical habitat data, and species occurrence data into a final 3 year summary report in spring 2010.

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